

16
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WAR DEPARTMENT.

193

MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

JANUARY, 1888.

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List of merchant marine steam and sailing vessels from which International Simultaneous Meteorological reports were received at the Office of the Chief Signal Officer, U. S. Army, Washington, D. C., in time to be used in the preparation of the Weather Review for the month of January, 1888.

Name of vessel.	Captain.	Name of vessel.	Captain.	Name of vessel.	Captain.
<i>Atlas Line.</i>		<i>National Line—Continued.</i>		<i>Miscellaneous—Continued.</i>	
Br. s.s. Manitoban.....	Capt. Wm. Dunlap.	Br. s.s. France.....	Capt. A. D. Hadley.	Steamship Elpis.....	Capt. F. Burnett.
Scandinavian.....	John Park.	Holland.....	Tbos. Foot.	Earnwell.....	C. N. Mumford.
Siberian.....	R. P. Moore.	Italy.....	Wm. Pearce.	Herschel.....	G. Braithwaite.
Hibernian.....	John Brown.	Spain.....	W. A. Griffiths.	Joshua Nicholson.	C. H. Regn.
Norwegian.....	H. Carrathers.	Helvetic.....	G. Cochran.	Marcia.....	L. O. Moon.
American Line.		The Queen.....	T. P. Heeley.	Marsala.....	N. Maas.
Br. s.s. British King.....	John Kelly.	N. Y., Havana & Mexico Mail S. S. Co.		Martello.....	W. Abbott.
British Prince.....	S. Nowell.	Am. s.s. City of Washington.....	W. M. Rittig.	Meutimore.....	G. W. Simpson.
British Princess.....	E. H. Freeth.	North German Lloyd Steamship Co.	H. Baur.	Minola.....	T. L. Evans.
Am. Indiana.....	W. J. Boggs.	Ger. s.s. Elder.....	Th. Jungst.	Nantasket.....	E. A. Richardson.
Lord Clive.....	P. Urquhart.	Ems.....	B. Ringk.	Navarro.....	S. de Aldecoa.
Br. Lord Gough.....	E. M. Hughes.	Hermann.....	A. Kohlman.	Netley Abbey.....	H. N. Vyvyan.
New York.....	G. W. Mason.	Rhein.....	W. Toper.	Oranmore.....	B. Jones.
Anchor Line.		Saale.....	H. Richter.	Oxford.....	W. Jones.
Br. s.s. Australia.....	G. Franck.	Werra.....	R. Bassius.	Polaris.....	John Schad.
Anchoria.....	J. Jameson.	America.....	H. Bruns.	Procida.....	W. Bannon.
Columbia.....	T. Mitchell.	Eibe.....	G. Meyer.	River Avon.....	J. Cleary.
Caledonia.....	F. Hassencastel.	Ocean Steamship Company.	J. W. Catherine.	Surrey.....	E. Griffiths.
Devonia.....	W. G. Crookhart.	Am. s.s. City of Augusta.....	J. E. Dale.	Tomas Brooks.....	E. F. Canal.
India.....	John Jameson.	Old Dominion Steamship Company.	Frank Stevens.	Viola.....	L. Murray.
Trinacria.....	G. Mitchell.	Am. s.s. Brooklyn.....	L. Dexter.	Warwick.....	L. Morice.
Atlas Line.		Manhattan.....	F. Henderson.	Winston.....	J. B. Millard.
Br. s.s. Alva.....	J. Evans.	Pacific Mail Steamship Company.	C. C. Lima.	Wundrahm.....	C. W. Robson.
Alvena.....	F. McKay.	Am. s.s. City of Paris.....	Newport.....	Yorkshire.....	P. M. Arnold.
Alvo.....	D. Williams.	Quebec Steamship Company.	J. S. Garvin.	<i>New York Herald Weather Service.</i>	
Athos.....	H. Low.	Br. s.s. Orinoco.....	G. S. Locke.	Steamship Adriatic.....	J. G. Cameron.
Atlas.....	J. W. Tobin.	Muriel.....	Sam. Hess.	Alvo.....	D. Williams.
Beaver Line.		Red "D" Line.....	W. A. Beynon.	Arabic.....	W. M. Smith.
Br. s.s. Lake Superior.....	W. Stewart.	Am. s.s. Philadelphia.....	A. J. Griffin.	Aurania.....	W. H. P. Hoins.
Books Line.	H. Thompson.	Belg. s.s. Llandaff City.....	H. E. Nickels.	Bohemia.....	R. Karlowa.
Br. s.s. Basil.....	T. H. Gore.	Brooklyn City.....	Rud. Weyer.	Brooklyn City.....	W. Pitt.
Bristol-City Line.	W. Pitt.	Belg. s.s. Fred Star Line.....	J. Uberweg.	Buffalo.....	J. F. Malet.
Br. s.s. Llandaff City.....	Brooklyn City.....	Belg. s.s. Red Star Line.....	C. H. Grant.	Chalmette.....	J. B. Ponc.
Carr's Line.		Belgenland.....	H. Buschmann.	City of Alexandria.....	John Deane.
Ger. s.s. California.....	O. Winkler.	Nederland.....	Com. W. G. Randle.	City of Chicago.....	Fred Deane.
Polynecla.....	A. Kühn.	Noordland.....	Capt. W. Ponson.	City of Richmond.....	Bedford.
Crowell Line.		Pennland.....	G. Stenger.	Eibe.....	J. H. Bennett.
Am. s.s. Hudson.....	H. R. Freeman.	Switzerland.....	A. Potjer.	Eureka.....	G. Mayer.
Louisiana.....	E. V. Gager.	Vaderland.....	B. Bakker.	Herschel.....	G. Braithwaite.
New Orleans.....	T. P. C. Halsey.	Waeeland.....	v. d. Zee.	Holand.....	F. Foot.
Clyde Line.		Westernland.....	C. W. Read.	Hudson.....	H. B. Freeman.
Am. s.s. Yemenese.....	1st Off. J. C. Norton.	Rotterdam Line.....	G. Moodie.	Landsdaff City.....	T. H. Gore.
Coward Line.		Capt. W. H. P. Hains.	J. Campbell.	La Normandie.....	G. de Kerialec.
Br. s.s. Aurora.....	Henry Walker.	Am. s.s. Zaandam.....	A. J. A. Mann.	La Gascogne.....	Santelli.
Cephalonia.....	M. Murphy.	Leerdam.....	J. A. Stewart.	Martello.....	Wm. Abbott.
Gallia.....	A. McKay.	Schiedam.....	W. H. Rutherford.	Mineola.....	T. L. Evans.
Pavonia.....	J. B. Watt.	Edam.....	H. Campbell.	Muriel.....	Geo. S. Lock.
Samaria.....	H. McKay.	Royal Mail Steamship Co.	A. G. Thomsen.	Nederland.....	A. Griffin.
Servia.....	W. McMickan.	State Line.....	T. H. Land.	Nevada.....	John Douglass.
Umbria.....	T. Dutson.	State of Georgia.....	A. Hyde.	New Orleans.....	T. P. C. Haley.
Bothnia.....		State of Indiana.....	F. Archer.	Nordland.....	H. E. Nickels.
Earn Line.		State of Pennsylvania.....	Koch.	Orinoco.....	J. S. Garvin.
Br. s.s. Karnmoor.....	J. Douglas.	State of Nevada.....	E. W. Owens.	Peruvian.....	Samuel Hoen.
Furress Line.	E. Bentley.	Stag Line.....	W. W. Gileig.	Philadelphia.....	H. Davidson.
Br. s.s. British Queen.....	C. L. Bigby.	Br. s.s. Saint Bonans.....	R. Williams.	Phindelphia.....	H. Vogelgesang.
Stockholm City.		Thingwalla Line.....	Palestine.....	Rhætia.....	G. Moodie.
Fr. s.s. La Bourgogne.....	E. Franguel.	Dan. s.s. Hekla.....	Roman.....	Sanams.....	A. G. Bras.
La Champagne.....	L. Boyer.	Thingwalla.....	White Cross Line.	Spain.....	F. Archer.
La Normandie.....	G. de Kersabec.		J. J. Brarens.	State of Georgia.....	C. H. Grant.
La Gascogne.....	Santelli.	Richmond Hill.....	H. Meyer.	State of Nevada.....	H. Buschmann.
Guion Line.		Ludgate Hill.....	I. G. Cameron.	Tower Hill.....	L. Moreton.
Br. s.s. Nevada.....	J. Douglas.	Tower Hill.....	P. J. Irving.	Waesland.....	R. Bassius.
Wisconsin.....	E. Bentley.	Union Line.....	H. Davidson.	Warwick.....	C. L. Rigby.
Wyoming.....	C. L. Bigby.	Br. s.s. Buffalo.....	B. Glendell.	Wyoming.....	United States Naval.
Hamburg-American Line.		White Star Line.....	G. Burton.	U. S. S. Atlanta.....	F. M. Bus.
Ger. s.s. Bohemia.....	R. Karlowa.	Br. s.s. Adriatic.....	J. H. Malef.	U. S. F. C. Albatross.....	T. S. Larn.
Moravia.....	C. Hebib.	Celtic.....	John Harrison.	U. S. S. Dolphin.....	G. F. F. W.
Rhaetia.....	H. Vogelgesang.	Republic.....	T. M. Irwin.	U. S. S. Galona.....	C. M. Che.
Rugia.....	A. Albers.	Baltic.....	R. N. Bristow.	U. S. S. Independence.....	J. W. Phi.
Slavonia.....	H. Schmidt.	Wilson Line.....	R. Potter.	U. S. S. Michigan.....	H. F. Pick.
Suevia.....	C. Ludwig.		R. T. Jones.	U. S. S. Ranger.....	F. A. Coo.
Inman Line.		Egyptian Monarch.....	J. W. Jones.	U. S. S. Richmond.....	Robert Boyd.
Br. s.s. City of Berlin.....	T. S. Land.	Marengu.....	T. C. Huggett.	U. S. S. Wabash.....	J. N. Miller.
City of Chicago.....	Fred Watkins.	Persian Monarch.....	F. W. Ouston.	<i>Sailing vessels.</i>	
Ohio.....	R. W. Sargent.	Santiago.....	B. H. Rogers.	Br. bk. Abyssinia.....	B. R. Hilton.
Pennsylvania.....	A. D. Thomas.	Gaile.....	D. Pert.	Ger. bk. Arnold von Bippen.....	F. Möller.
Johnston Line.		Chicago.....	G. W. Read.	schr. Anita.....	S. Small.
Br. s.s. Baltimore.....	J. Trenerry.	Lydian Monarch.....	J. R. Brady.	sp. Carolina.....	A. Ugalde.
Neasmere.....	G. Elliott.	Sorrento.....	A. R. Smith.	Charls. S. Whitney.....	G. D. Spicer.
Legland Line.		Salerno.....	L. Dulac.	Emiliano.....	D. F. de Bent.
Br. s.s. Dublin.....	Robt. Leask.	Miscellaneous.	A. Macnicol.	Am. bk. Ethel.....	Wm. Thompson.
Irishman.....	E. Parry.	Auretta.....	A. R. McLean.	schr. Fastino.....	R. Philbrook.
Mallory Line.	T. H. Fox.	Bengore Head.....	B. H. Rogers.	bk. Florence.....	A. P. Carter.
Am. s.s. Diana.....	Samuel Risk.	Bosphorus.....	D. Pert.	sp. Galilejo.....	
Colonial.....	J. Daniel.	Burgundia.....	G. W. Read.	Am. bk. Harrist S. Jackson.....	W. T. Bacon.
Ido Grande.....	M. B. Crowell.	Carthaginian.....	J. R. Brady.	Am. bk. John H. Crandon.....	W. T. Richard.
Nueces.....	Jas. F. Lewis.	Concordia.....	A. R. Smith.	Port. bk. Julius.....	D. Vieiga.
Carondelet.....	J. Bolger.	Counsellor.....	L. Dulac.	Swed. Komandor Svend Foyn.....	H. F. Schive.
Mediterranean & N. Y. Steamship Co.	W. F. Evans.	Croma.....	A. Macnicol.	bk. Martin Luther.....	A. O. Arnone.
s.s. Ponca.....			A. R. McLean.	bk. Pillau.....	G. Gerlack.
Mississippi & Dominion Steamship Co.			B. H. Rogers.	bk. Sodium.....	W. Manson.
Br. s.s. Vancouver.....	C. J. Lindall.		D. Pert.	bk. Salina.....	J. Peters.
Sarina.....	J. Gibson.		G. W. Read.	bkt. Yose E. More.....	A. Lenhard.
Morgan Line.			J. R. Brady.		
Am. s.s. Europa.....	R. B. Quick.		A. R. Smith.		
National Line.			L. Dulac.		
Br. s.s. Canada.....	J. Robinson.		A. Macnicol.		
Denmark.....	R. S. Rigby.		A. R. McLean.		
Egypt.....	J. Summer.		B. H. Rogers.		
Erin.....	Wm. Tyson.		D. Pert.		

UNITED STATES SIGNAL SERVICE MONTHLY WEATHER REVIEW.

VOL. XVI.

WASHINGTON CITY, JANUARY, 1888.

No. 1.

INTRODUCTION.

This REVIEW treats generally the meteorological conditions of the United States and Canada for January, 1888, and is based upon the reports of regular and voluntary observers of both countries. Descriptions of the storms that occurred over the North Atlantic Ocean are also given, and their paths shown on chart i., on which also appear the positions of icebergs and the limits of fog-belts west of the fortieth meridian. The weather over the north Atlantic was seasonable, and no storms of abnormal energy have been reported.

The month may be rated as an unusually cold one over the greater part of the United States, particularly on the Pacific coast in the plateau region, and in all northern districts, the temperatures generally ranging from 6° to 12° below the normal. In the south Atlantic and Gulf states, and in the southern slope, the mean temperatures were normal or slightly above.

In connection with the temperature of the month, the remarkably cold weather in the northwestern states and territories, attending the prevalence of area of high pressure number iii., was an important feature. This extremely cold weather prevailed during the second decade of the month, and some of the minimum temperatures were the lowest recorded since the establishment of Signal Service stations. The minimum temperatures at many stations in the plateau region and on the Pacific coast during the decade mentioned, were similarly without precedent for that region.

The monthly precipitation was decidedly below the normal in Florida, the south Atlantic and east Gulf states, and largely in excess of the average in California. In other portions of the country it was nearly normal.

With this REVIEW is given an annual summary of temperature and rainfall for 1887, with two charts (numbers v and vi) showing, respectively, annual isotherms and departures from normal temperature, and annual precipitation.

In the preparation of this REVIEW the following data, received up to February 20, 1888, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at 133 Signal Service stations and 23 Canadian stations, as telegraphed to this office; 176 monthly journals and 170 monthly means from the former and 23 monthly means from the latter; 307 monthly registers from voluntary observers; 56 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the Hydrographic Office, United States Navy, and the "New York Herald Weather Service;" monthly weather reports from the local weather services of Alabama, Colorado, Illinois, Indiana, Kansas, Louisiana, Michigan, Mississippi, Missouri, New Jersey, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, and Tennessee, and the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean pressure for January, 1888, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

The mean pressure for January, 1888, is greatest in the upper Mississippi and Missouri valleys, and least in New England and the Maritime Provinces of Canada, there being a difference of 0.54 between the highest (Omaha, Nebr., 30.34) and lowest (Sydney, N. S., 29.80) monthly barometric means. From the upper Mississippi valley eastward the decline in the barometric means is gradual until reaching the seventy-fifth meridian; thence eastward the gradient is remarkably steep, the mean pressure ranging from 30.18, at Albany, N. Y., to 29.80 at Sydney, N. S. To the westward of the Missouri Valley the mean pressures first decrease to 30.1 over the middle Rocky Mountain slope; thence westward they increase to 30.25 in the northern and middle plateau districts, and from this region westward to the Pacific coast there is a sharp decline, the barometric means falling slightly below 30.0 on the north Pacific coast.

The contrast between the highest and lowest monthly mean pressures is worthy of special mention. The average difference between the highest and lowest barometric means for January for the territory embraced by the chart is about .35, and since

the establishment of Signal Service stations there has been but one year, viz., 1879, in which the range of mean pressure has equaled that of the current month.

The mean pressure of January, 1888, as compared with that for the preceding month shows an increase in all parts of the country, with the exception of the Canadian Maritime Provinces and the middle and south Pacific coast regions, in which districts there has been a slight decrease, ranging from .01 to .07. Throughout the region between the eighty-fifth and one hundred and second meridians the barometric means ranged from .15 to .24 higher than for the preceding month, the difference being greatest in the upper Mississippi and lower Missouri valleys.

The departures from the normal pressure at the various Signal Service stations are given in the table of miscellaneous meteorological data. In all parts of the country, with the exception of the northern and middle Pacific coast regions, the Canadian Maritime Provinces, and northern New England, the mean pressure for the month is above the normal, the departures exceeding .10 over an extensive area in the interior of the country, and amounting to .15 in the upper Mississippi valley. The stations reporting extreme departures above and below normal are respectively La Crosse, Wis., .17, and Roseburg, Oregon, .08.

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are also given in the table of miscellaneous meteorological data. In the states bordering on the Atlantic coast the extreme ranges are .27 at Key West, Fla., to 1.98 at Eastport, Me.; between the eighty-fifth and one hundredth meridians, .69 at Mobile, Ala., New Orleans, La., and Pensacola, Fla., to 1.62 at Green Bay, Wis.; on the Pacific coast, .70 at San Diego, Cal., to 1.37 at Olympia and Tatoosh Island, Wash. In the south Atlantic states and extreme northwest the monthly ranges are slightly lower than normal for January, but in all other districts they are decidedly above the normal; the most marked departures occur over the region from the Missouri Valley westward to the Pacific coast, and from the Lake region eastward to the New England coast, where they exceed the normal from .25 to .75.

AREAS OF HIGH PRESSURE.

During the month of January six well-defined areas of high pressure were observed within the limits of territory covered by the tri-daily weather charts. All of these areas apparently descended from the northwest to the northern boundary of the United States, and the centres of all were first located between the one hundred and second and one hundred and seventeenth meridians. The general course of four of the areas was first in a direction south of east until between the fortieth and forty-fifth parallels, then to the north of east. The high area described below as the latter part of number iii moved first to the southwest until over the southwestern corner of Idaho, then to the southeast until near the Gulf of Mexico, after which it moved in an easterly direction. The area described as number vi moved first in a direction south of east until central over the north shore of Lake Superior, after which it crossed the states, moving almost directly south.

The following is a description of the areas of high pressure observed during the month, with the marked weather conditions prevailing during each:

I.—At 3 p. m. of the 3d an area of high pressure appeared to the north of Montana and, moving eastward, on the morning of the 5th covered the northern portion of the United States from Montana to New York, its centre remaining far to the north of Manitoba. This extension of high pressure to the eastward was accompanied during the 4th and on the morning of the 5th by light snows, with light winds, and at 10 p. m. of the 4th by a fall of from 20° to 30° in temperature over the northern and middle slopes of the Rocky Mountains. On the afternoon of the 5th the eastern portion of this area separated from the western portion and, with rapidly decreasing pressure, moved to the eastward and passed beyond the coast at midnight of the 6th. The western portion began to extend to the southeast, carrying with it a cold wave, during which the fall in temperature in twenty-four hours in the different districts affected by the wave ranged from 20° to 50°. This cold wave embraced the northern, middle, and southern slopes of the Rocky Mountains, the Missouri Valley, the upper Mississippi valley, and the southern part of the Ohio Valley and Tennessee, and caused a decided fall in temperature along the Gulf coast. On the morning of the 8th all of the United States west of the eighty-seventh meridian was covered by the area. Its centre was located just north of Montana from midnight of the 6th to the afternoon of the 8th, when again the area divided; one portion, attended by a still further fall in temperature, moving to the southeast with rapidly decreasing pressure, disappeared over Kansas after the 3 p. m. observation of the 9th; the other portion, moving to the southwest, assumed a position over Idaho, where it remained, with slight changes of position and increasing pressure, until the afternoon of the 9th, when the pressure, which had reached a height of 31.00 at Boise City, began to decrease, and at midnight of the 11th the area had disappeared.

From the 6th to the 12th low temperatures were experienced throughout California. Killing frosts occurred, and ice formed in some places to the thickness of four inches.

The following are extracts from the daily journals of regular Signal Service stations in California:

Red Bluff, 6th: killing frost formed on the roof to the depth of one-half inch. 8th, lowest temperature since 1883, 19°.3; killing frost.

Sacramento, 7th: clear and cold, with killing frost; ice formed four-tenths of an inch thick on water in a tub on the roof. 8th, clear and cold, with an unusually heavy, killing frost; ice formed one-half inch thick; outside water pipes frozen up until sometime in the afternoon. 9th, clear and cold, with unusually heavy, killing frost, which remained on the ground all day in unexposed places; water pipes still frozen up. 10th, 11th, and 12th, clear, with killing frost; water pipes frozen up.

San Francisco, 6th: killing frost and ice visible this morning; continued clear throughout the day. 7th, killing frost and ice; continued cold and clear during the night. 8th, killing frost and ice, remained unmelted throughout the day in places partly sheltered. 9th, killing frost and ice this morning. The weather remained clear, not a cloud being visible during the day. The snow had disappeared from Mount Tamalpais, but some still remained on Mounts Diablo and Hamilton and about the foot-hills east of station. 10th, ice observed this morning, but no frost. 11th and 12th, ice and frost observed.

Fresno, 6th: cold, raw day; killing frost. 7th, killing frost; the heaviest the observer ever saw in the valley; it was three-sixteenths of an inch deep, and roofs looked as though covered with snow; at 11 a. m. dense fog formed, and cleared away at 6 p. m., coming on again at 11.30 p. m. 8th, coldest day of the winter; oldest inhabitants say this is the coldest day ever known in the valley; observer went out among the orange groves, which do not seem to be injured by frost or cold; ice formed one-fourth of an inch thick, and the ground is frozen quite hard; 9th, 10th, 11th, and 12th, killing frost.

Los Angeles, 7th: a clear and cold day. Heavy frost and ice formed this morning. The mud in many of the streets froze, and pools of water were covered with a skim of ice. The mountain ranges visible to-day are heavily covered with snow nearly to the base. While no damage is reported to the fruit crop, fears are entertained for the safety of the oranges, especially should the cold continue. 8th, heavy frost and ice formed this morning. In some localities the ice was three-fourths of an inch thick, and remained unmelted all day in northern exposures. The mud in the streets and the surface earth froze in many places. Flowers in many places were damaged. No damage is yet reported to the oranges. 10th, very cold this morning; minimum temperature, 30°.9, the lowest recorded at the station since February 6, 1883, when it was 28°. Heavy frost and ice formed, and the ground froze in many localities. Vegetable gardens suffered seriously from the extreme cold of the past few days.

San Diego, 7th: light frost this morning, the first since August, but did not injure vegetation. 8th, very cool weather; minimum temperature down to 33°. A thin film of ice formed on shallow pools of water in the streets and a light frost was visible in the early morning; mountains covered with snow. 9th, light frost and ice appeared on the streets this morning. 10th, very cool, with light frost this morning. In the Cajon Valley the temperature was reported at 22° at sunrise yesterday morning.

II.—This area first appeared on the afternoon chart of the 10th. It was very elongated toward the southeast. At the succeeding observation it had extended to the Gulf of Mexico and its centre was located to the north of Dakota. From this position it moved to the southeast, with increasing pressure, until the afternoon of the 11th, after which it moved in an easterly direction and passed off the coast of Nova Scotia on the morning of the 13th. It was attended throughout its entire course by fair weather and light winds, except on the New England and middle Atlantic coasts, where northwesterly gales prevailed during the 11th. The fall in temperature ranged from 10° to 20°, the latter occurring in only a few instances.

III.—On the morning chart of the 12th an area of high pressure appeared to the north of Montana. On this chart was also shown a well-defined area of low pressure central near Cheyenne, Wyo., the subsequent course of which was to the southeast till central near Concordia, Kans., at 3 p. m., then rapidly to the northeast. At 10 p. m. of the 12th the area of high pressure had extended to the southeast over Montana, Dakota, and Nebraska, while the pressure at its centre had increased to 30.9, the centre of the area of low pressure before mentioned being located near La Crosse, Wis., and bounded by an isobar of 29.6, there being a difference of pressure of 1.3 between the centres of the two areas, separated by about 1,200 miles. This marked difference in pressure caused winds of from thirty to fifty miles an hour, accompanied, at some stations in Montana, Dakota, and Nebraska, by snow, which, with a fall of from 30° to 60° in temperature during the twenty-four hours preceding the 10 p. m. observation of the 12th, helped to make a violent storm in which many lives were lost and large numbers of cattle perished.

On the morning of the 13th the area had spread still farther to the southeast over Iowa, Missouri, and Kansas, carrying the cold wave with it, but with somewhat diminished intensity. At midnight it had extended more to the northeast, in rear of the area of low pressure referred to above, carrying with it the intensely cold wave, during which the fall in temperature in twenty-four hours was from 30° to 50° over Minnesota, Wisconsin, Illinois, Indiana, and western Michigan. At the 7 a. m. observation of the 14th the area had extended to the Atlantic coast over New England and the middle Atlantic states, but the cold wave was greatly diminished in intensity.

The following extracts from the daily journals of regular Signal Service stations are given to show the progress and intensity of this cold wave:

Fort Assinaboine, Mont., 11th: rapidly falling barometer and rising temperature. The wind changed from the northwest to southwest at 8.30 p. m., bringing a warm, "chinook" wind, when suddenly at 7.45 p. m. it changed its direction to northwest. High winds blew for two hours. A gale of forty-eight miles, north, was registered at 8.55 p. m., continuing forty-five minutes. A great amount of electricity was present in the air. 12th, rapidly rising barometer and a sudden fall in temperature. Brisk winds all day from the north.

Helena, Mont., 12th: at 2.30 a. m. the exposed thermometer read 38°, with wind veering to the northwest. Between this time and the 7 a. m. observation the maximum thermometer indicated a temperature of 40°.5, and the minimum registered was -9°.0, making a fall of 49°.5 in four hours and thirty minutes. At 10 p. m. the minimum thermometer registered -26°.0, making a total fall of 66°.5 in less than twenty-four hours.

Poplar River, Mont., 11th: growing warmer at 11 a. m.; falling barometer. 12th, colder, high northwest wind; snow all blown into drifts and temperature -22° and falling.

Fort Custer, Mont., 11th: clear and pleasant weather. 12th, colder, cloudy weather. Light snow began during night and ended at 7.27 a. m. The snow was accompanied by high northerly winds which began at 2.42 a. m. and ended 9.30 a. m., with maximum velocity of forty-nine miles. This storm, commonly known as a "blizzard," was the severest of the season. No lives in this immediate vicinity are reported to have been lost. Travel on the Northern Pacific is completely blocked, owing to the drifting snow and intense cold. Solar halo, with contact arch, visible nearly all day.

Bismarck, Dak., 11th: rapidly falling barometer and rapidly rising temperature; high east winds, veering to southeast. 12th, order to hoist cold-wave signal received 1.20 p. m.; northwest gale began at 6.30 a. m. and continued all day; highest velocity, fifty-four miles, northwest. The wind shifted to northwest at 6 a. m., increasing in force, drifting the snow which had already fallen and that which was falling to depths of five to twenty feet. This, with rapidly falling temperature, constituted a well-defined "blizzard"; trains on the Northern Pacific Railroad are delayed and travel in small conveyances suspended. 14th, cold-wave signal lowered 12.15 p. m.; minimum temperature, -37°.

Fort Totten, Dak., 11th: fall in barometer, rise in temperature, wind north, changed to south and blew a gale, velocity fifty-two miles per hour at 11 p. m.; temperature continued to rise till midnight. 12th, rising barometer, wind southeast, changed to north at 7.45 a. m., and blew a gale during the day; cold wave signal ordered up at 1 p. m.; minimum temperature -26°; trains stopped.

Saint Vincent, Minn., 12th: low barometer, rising rapidly; gale ended at 5.25 a. m.; maximum velocity thirty-six miles south; cold-wave signal ordered up at 12.30 p. m.; at 1 p. m. a "blizzard" struck here; beginning at 2.40 p. m. the wind blew a terrific gale, attaining a velocity of from thirty-six to forty-eight miles from 3 p. m. to 2 a. m. of the 13th; cold-wave signal lowered at 7 a. m.; maximum temperature 2°, minimum temperature -40°. The display of cold-wave signals occasioned considerable favorable comment.

Huron, Dak., 12th: the southerly gale of yesterday and last night continued, with light snow, until 6 a. m., when the gale began to abate; at 12 m. its velocity was twenty-four miles per hour; between 12.35 and 12.40 a. m. it had subsided to twelve miles, with a light snow and damp atmosphere, the sky being obscured in patches by nimbus clouds; at 12.42 p. m. the air was perfectly calm for about one minute; the next minute the sky was completely overcast by heavy black clouds which, for a few minutes previous, had hung along the western and northwestern horizon, and the wind veered to the west and blew with such violence as to render the position of the observer on the roof unsafe. The air was immediately filled with snow as fine as sifted flour. The wind veered to the northeast, then backed to the northwest in a gale which, in three minutes, attained a velocity of forty miles an hour. These conditions continued steadily all day and till 4 a. m. of the 13th, when the gale began to abate and the snow soon after ceased. Cold-wave signals hoisted at 2.35 p. m. At noon the temperature was 20°, and at 10 p. m. -17°, and fell to -28° during the night. The wind averaged from forty-five to fifty miles, and attained an extreme velocity of sixty miles per hour. The number of lives lost in this (Beadle) county is eleven, and a considerable number injured.

Moorhead, Minn., 12th: wind during the early a. m. and forenoon extremely violent; maximum velocity fifty miles, south. Cold-wave order received 1.30 p. m. There was a sudden change of wind from south to north at

1.45 p. m. Heavy, blinding snow at intervals. 14th, cold-wave signal display terminated. Maximum temperature during display, 12°; minimum temperature, -32°; range of temperature, 44°.

Yankton, Dak., 12th: at about 2.30 p. m. the wind suddenly changed from south to north, blowing with increasing violence and accompanied by snow. The temperature fell rapidly, and the worst "blizzard" known in this region for years set in. Cold-wave signal received 4.30 p. m.

Crete, Nebr., 12th: light, moist snow commenced in the early morning, and at 9 o'clock heavy snow was falling, which continued till 4.30 p. m. Cold-wave signal hoisted 1.30 p. m. There was but little wind, and the temperature ranged from 25° to 30°. At 4.10 p. m. the wind suddenly sprang into a gale, shifting from south to northwest. The temperature fell 18° in less than three minutes. The snow drifted so badly as to render all travel extremely difficult and dangerous.

North Platte, Nebr., 12th: barometer fell rapidly during the night until 9 a. m., when it commenced to rise. Light snow, accompanied by southwest wind, began falling during the night and ended at 9 a. m. Hoist cold-wave signal received 1.20 p. m. Wind changed from south to the northwest, attaining a velocity of forty miles at 3 p. m. Temperature fell 32° in thirteen hours. 14th, lowered cold-wave signal 1 a. m. Justified. Maximum temperature during display, 4°; minimum temperature, -26°.

Topeka, Kans., 12th: barometer fell rapidly till after 3 p. m., with brisk southerly winds and rising temperature. At 6.34 p. m. the wind, without warning, veered to the northwest and instantly increased from twenty-four miles per hour to sixty-six miles per hour; gradually diminishing in force, it was still forty-two miles at 10 p. m. Clouds soon cleared after 7 p. m. From 6 to 10 p. m. the temperature fell from 34° to 2°.

Omaha, Nebr., 12th: light southeast wind prevailed during early part of the day and up to 5.17 p. m., when it suddenly shifted to northwest and instantly increased to thirty miles; at the same time the temperature began falling rapidly; at 3 p. m. was 27°, and at 10 p. m. -6°, showing a fall of 33° in seven hours. Order to hoist cold-wave signal received 1.40 p. m.

Cheyenne, Wyo., 12th: maximum wind of sixty miles, northwest, at 7.53 p. m. 13th, snow began at 4.15 p. m. The temperature fell from 14° at 3 p. m. to -10° at 5 p. m., and to a minimum of -20° during the night.

Denver, Colo., 12th: very high wind during the day, reaching a velocity of sixty miles per hour, north, at 3.30 p. m. Instrument shelter was blown down, tearing some of the roof with it. Hoist cold-wave signal received 7.32 p. m. Temperature when hoisted, 28°. 13th, high wind in the afternoon, reaching a velocity of thirty miles, north, at 4.05 p. m. Cold-wave signal lowered at 10 p. m. Cold-wave warning was not only justified but was followed by one of the most severe cold waves that ever struck this section.

The postmaster at Lisbon, Dak., reports as follows concerning this storm:

"The thermometer on January 11th stood at 10° above zero; the wind, with a blinding snow storm, came from the south; velocity about thirty miles per hour. At 11 a. m., same date, the wind changed to the north; the thermometer went to zero; the wind continued at thirty miles per hour until 11 p. m., at which time it blew at least forty miles per hour, and the snow flew so one could not see across the street when a bright light was burning. At daylight January 12th, the wind was still blowing very hard, and the thermometer registered 18° below zero. This morning, January 13th, 7 a. m., the thermometer is 35° below zero; wind still from the north and getting colder."

Keokuk, Iowa, 12th: cold-wave signal hoisted 7.30 p. m., temperature then 30°. 13th, wind veered to the west at midnight, blowing a gale of thirty-six miles per hour at 12.15 a. m.; temperature fell rapidly, and at 8 a. m. had fallen 55° in eight hours. 14th, cold wave signal lowered at 7 a. m.; range of temperature during display was from 45° to -13°.

Des Moines, Iowa, 12th: order to hoist cold-wave signal received 7.55 p. m. 13th, the high wind of last night continued until 6 a. m. to-day, causing immense snow drifts in railroad cuts; range of temperature in sixteen hours ending 7 a. m. 42°.

Saint Paul, Minn., 12th: light to moderately heavy snow began 10.15 a. m. and ended 11.35 p. m.; snow drifted very badly; cold-wave signal hoisted 6.50 p. m. 13th, very cold, fresh to brisk northwest winds, diminishing in force in the afternoon. Railway trains over the roads extending in every direction from here, except the Wisconsin Central to Chicago and the short line trains from here to Minneapolis, neither arrived nor departed during the day. 14th, cold-wave signal lowered at 7 a. m.; display justified; maximum temperature during display, 12°; minimum temperature, -24°.

La Crosse, Wis., 12th: order to hoist cold-wave signal received 8 p. m. 13th: light snow ended during the night; wind increased in velocity from the west and temperature fell from 19° to -6° in a. m. and continued to fall rapidly until after 10 p. m. when it reached -20°. 14th, cold-wave signal down; justified; maximum temperature, 19°, after 10 p. m. of the 12th; minimum this morning, -22°, a fall of 41° in thirty-one hours.

The "blizzard" was most destructive in its effects in middle and southern Dakota, which is probably due to the fact that it came upon that section of the territory between 10 a. m. and dark, when many people would naturally have been away from shelter, as the weather previous to that time was warm and pleasant. The loss of life as given in newspaper accounts has been doubtless exaggerated, but was evidently greater than in any previous storm, owing to the extensive settlement of the country in the last few years. The change in direction of wind

and fall in temperature were more sudden than is usual, but the most violent part of the storm was of short duration, not lasting longer than thirty-six hours at any place, and, at some places, less than twenty-four hours. Some Dakota storms in previous years have been more severe, especially the storm of January 7th to 10th, 1873.

On the afternoon of the 14th the extension of high pressure was more to the southwest and the middle and southern slopes were visited by a severe cold wave, accompanied by light snow, during which the fall in temperature was from 30° to 50° in twenty-four hours. On the morning of the 15th the whole of the United States was covered by this high area, which was dividing into two portions, one remaining still central over Idaho, the other central over Kansas. The cold wave had moved to the southeast over the west Gulf states and freezing temperatures were reported from San Antonio, Galveston, Corpus Christi, Rio Grande City, Brownsville, Tex., and Shreveport, La. From its position over Kansas the eastern portion of this area moved to the northeast, and, with slowly diminishing pressure, passed beyond the coast at 3 p. m. of the 17th. The cold wave, accompanied by snow, excepting along the Gulf coast where rain fell, advanced during the 15th and 16th over the eastern Gulf states, Tennessee, and the south Atlantic states.

The following extracts from daily journals of regular Signal Service stations are given to show the intensity of the cold wave over the southern slope of the Rocky Mountains and the west Gulf states:

Fort Elliott, Tex., 14th: "norther" struck the station at 8 a. m. Light snow began 6.40 a. m., ended 8.30 a. m.; cloudy weather; mean temperature of the day, -7° , the coldest day on record. Rapidly rising barometer, with very high wind; maximum velocity forty-eight, north. 16th, "norther" continues. Coldest temperature since the establishment of station, -14° , this a. m.; gale forty miles, north. Cloudy during day, clear at night.

Abilene, Tex., 14th: pleasant weather during the early part of forenoon. A brisk "norther" began blowing at about 10 a. m., with the temperature falling rapidly. At 10 p. m. the minimum temperature recorded was 2° below zero. Light, dry snow began 10.50 a. m., and continued. Order to continue cold-wave signal received at 2.50 p. m. 15th, at 7 a. m. the minimum thermometer registered 5° below zero, which is the coldest of which there is any record, and colder than the oldest residents have ever seen it.

Galveston, Tex., 15th: the wind shifted to northwest at 1 a. m., and soon reached the velocity of a storm. It was attended by light rain, which changed to snow at 4 a. m. A veritable "blizzard" is raging in Galveston to-day. The temperature is below freezing, the wind blowing at the rate of from thirty-six to forty miles an hour, with fine snow, or frozen mist, which cuts like drifting sand. The wind moderated somewhat during the afternoon and night. Every object out of doors coated with ice an inch thick.

Corpus Christi, Tex., 15th: a severe "norther" reached the station at 2 a. m., and the wind increased to a velocity of from thirty to thirty-six miles. The temperature fell rapidly from 60° at 2 a. m. to 16° at 10 a. m. The minimum temperature, 16° , was not reached until 7 p. m. A small fishing sloop was sunk in the bay near the station. Much suffering was caused by the extreme and sudden change in temperature.

Rio Grande City, Tex., 15th: terrific "norther" came on at 5.45 a. m., with rain, freezing as soon as fallen. Temperature fell 37° from 10 p. m. 14th to time storm came on, most of which occurred within a half hour. 16th, "norther" continues. All small receptacles filled with water froze solidly. General suffering and sickness among the Mexican inhabitants.

Brownsville, Tex., 15th: sudden change in pressure and temperature; minimum temperature, 23° ; wind freshened at 7 a. m., increasing to high (thirty-four miles) at 11 p. m.; light rain began during the night, changing to snow and sleet at 9 a. m. 16th, severe "norther"; minimum temperature, $21^{\circ}.4$; light sleet ended at 9 a. m.; trees, houses, and fences covered with ice an inch thick; coldest weather since December 31, 1880, and January 1, 1881, when minimum temperature was 18° . 17th, very light rain from 7.30 a. m. all day; slightly warmer; ice melting rapidly; not much damage to crops from storm of 15th and 16th, but cattle and people suffered greatly.

Vicksburg, Miss., 15th: hoist cold-wave signal received 7.20 a. m.; light rain began in the early morning, changed to sleet at 10 a. m. and ended 2.37 p. m. 16th, cold-wave signal lowered at 7 a. m.; the signal was justified, the temperature falling from 37° to 17° during the display.

The western portion of the high area which was central over Idaho on the morning of the 15th remained in that position until the morning of the 18th, when it was central over Colorado and Utah, with central pressure 31.06 reported from Montrose, Colo. From this position it continued to move to the southeast until near the Gulf coast of Texas, then in an

easterly direction until it passed off the coast of Georgia on the morning of the 20th. It was accompanied throughout its course from Colorado to the Atlantic by fair weather and slightly higher temperature, except on the coast of the east Gulf states, where it caused a limited cold wave on the 18th.

Unusually low temperatures were observed throughout California from the 14th to the 18th, and frost and ice were formed at places where they are of very rare occurrence.

The following extract from the daily journals of regular Signal Service stations in California will describe the unusually cold weather which prevailed:

Red Bluff, 14th: clear weather, with high northwest wind; minimum temperature, 18° , the lowest since the establishment of the station. 16th, light snow fell from 5 to 5.35 p. m., melting as soon as it reached the ground. 17th, a killing frost was observed this morning. 18th, a light frost this morning.

Sacramento, 14th: high northerly winds, clear and cold; minimum temperature this morning is the lowest recorded by the Signal Service at this station since July 1, 1877, and the coldest known since January 21, 1854, when Dr. Logan recorded 19° , which is the same as the minimum of to-day. Ice on water in a tub on the roof measured 1.1 inches in the centre of the tub. The average temperature to-day is 28° , and ice was forming all day in the shade. Slush ice was floating down the Sacramento River, the first time since 1854 that such a thing has happened. 15th, clear and cold, minimum temperature being the same as yesterday. On a small pond back of the railroad company's roundhouse, ice was thick enough to bear a man weighing one hundred and eighty pounds, and boys were skating upon it. 16th, clear and cold; killing frost observed in the morning; ice on the roof is three inches thick; boys are still skating on the pond. 17th, clear and cold, with killing frost; China Slough partially frozen over. 18th, killing frost.

San Francisco, 14th: weather continued clear and cold throughout the day, not a cloud being visible; the wind attained a velocity of forty miles per hour in the early morning, doing considerable damage to shipping and wharves in the northern section of city front; a pile-driver, valued at \$4,000, was capsized in Mission Bay; a number of vessels in different parts of the harbor parted their lines and coming into collision were damaged to some extent; water pipes were frozen in various parts of the city; ice in the gutters this morning was fully .5 of an inch in thickness. 15th, water in pipes frozen this morning, resulting in the usual damage by bursting; this is a thing of very rare occurrence in this city; the minimum thermometer read 29° this morning, being 4° lower than any previous record since the establishment of the station in 1871; the bottle of water kept in the instrument shelter was frozen solidly and did not thaw out until after 3 p. m.; ice was seen this morning fully 4 inches in thickness. 16th, light snow began falling at 10.20 p. m. and continued till 11.40 p. m., at which time it was 0.1 inch deep. 17th, snow remained unmelted in the western part of the city until after 3 p. m.

Fresno, 14th: no frost was visible as on other mornings but the ground was frozen hard. Orange growers in the country say it is the worst weather ever experienced here, but they do not think oranges are injured; a personal inspection of those in town shows no damage. Old residents say that nothing like this winter was ever known in the valley. 15th and 16th, killing frosts. 17th, water pipes in the building froze and burst; heavy frost in the morning; a light fog from 11 a. m. to 11.40 a. m. froze on the trees, presenting a beautiful appearance. 18th, killing frost.

San Diego, 17th: light frost this morning, also a thin film of ice on shallow pools of water on the street; no damage done to vegetation.

Los Angeles, 15th: minimum temperature 32° ; heavy frost and ice formed this morning. The observer was informed by a gentleman from this building who was duck-shooting at Balona, on the coast near Santa Monica, that ice formed on the sloughs thick enough to bear the weight of a small dog he had with him, and the ice remained till near mid-day before melting. 16th, very cold this morning, minimum temperature 31° ; heavy frost and ice formed; water pipes in many places froze solid. An eastern mail arrived to-day, the first received for a week, on account of the trains having been blockaded by snow in the mountains. 17th, light frost formed this morning.

IV.—The 7 a. m. chart of the 18th shows an area of high pressure advancing from the northwest over Montana and Dakota. It was central north of Montana from 10 p. m. of the 18th to 7 a. m. of the 20th, at which time it had extended to the southeast over the northern slope, the Missouri, and upper Mississippi valleys, and attended by fair weather, light winds, and a cold wave, the fall in temperature ranging from 20° to 40° . Its centre moved to the southeast until over southern Minnesota, then in a direction north of east until north of Lake Ontario, after which it moved south of east, with rapidly decreasing pressure, until it passed off the New Jersey coast on the afternoon of the 22d. It was accompanied throughout its course by generally fair weather. At midnight of the 20th the cold wave had extended southward over the middle and southern slopes of the Rocky Mountains. As the cold wave moved eastward it became very much diminished in intensity and

caused a fall of only 10° over the Lakes, the Ohio Valley, and the middle Atlantic states.

V.—On the morning of the 22d an area of high pressure began to appear to the northeast of Montana. It moved to the eastward, gradually extending to the southward, until in the afternoon of the 23d its centre was located in northeast Dakota, and the isobar of 30.3 included nearly all that portion of the United States between the eighty-second and one hundred and seventh meridians. From this position the area moved first to the southeast and afterwards to the eastward, keeping near the forty-fifth parallel, maintaining the maximum pressure, 30.6, until midnight of the 24th, when the pressure began to decrease, and it passed off the coast of New Brunswick at midnight of the 25th, when the pressure was but .01 above the normal. It was accompanied by light winds and generally fair weather, the temperature falling not more than 15° .

VI.—This disturbance was first noticed on the afternoon of the 26th to the north of Dakota. It extended to the southeast until at midnight of the 27th its centre, with pressure 30.6, was located over western Lake Superior, and the area extended to the Gulf of Mexico. From this position it began to move rapidly southward, with decreasing energy, and on the morning of the 29th it passed off the coast of Florida, the central pressure bounded by an isobar of 30.2, scarcely above the normal. This area was attended by fair weather, light winds, and only a slight fall in temperature, excepting over the Lakes and the Ohio Valley, where light snows occurred during the 27th, caused by the influence of a very active area of low pressure then to the northeast.

AREAS OF LOW PRESSURE.

Ten areas of low pressure have been traced during January over the territory occupied by stations of observation. Of this number, one is a continuation from December; five were first observed to the west of the Rocky Mountains; two originated in the territory to the north of Montana and Dakota; and two developed in the central valleys east of the ninetieth meridian. The average rate of movement of these depressions was 39.4 miles per hour, the general velocity of each depression ranging from 28.1 to 54.4 miles per hour.

The following table shows the latitude and longitude in which each area was first and last observed, and the average velocity in miles per hour:

Number of area.	First observed.		Last observed.		Average hourly velocity.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
I.....	° 44.00	123.45	° 46.20	84.30	28.1
II.....	48.50	118.20	39.40	93.15	50.0
III.....	43.00	124.30	32.45	104.00	26.1
IV.....	41.00	91.30	47.50	71.30	42.5
V.....	50.45	111.00	47.20	78.00	46.9
VI.....	48.50	119.30	31.50	106.20	31.7
VII.....	40.00	87.00	43.45	64.30	36.5
VIII.....	47.35	123.50	47.30	65.00	33.3
IX.....	48.20	125.00	41.35	93.45	54.4
X.....	51.45	90.40	37.00	77.20	42.0

Average rate of progress, 39.4 miles per hour.

I.—This area of low pressure is a continuation of number xi of the preceding month. On the morning chart of the 1st it is shown to be central near Escanaba, Mich., where the pressure was 29.22. It was attended by severe gales and snow over the Lakes on the morning of the 1st. Snow was also general in the interior of the New England and middle Atlantic states, and heavy rains occurred along the coast, where south to west gales prevailed on the 1st and 2d. Heavy rains occurred in Tennessee, Georgia, and Alabama. The area passed to the northeast beyond the region of observation during the succeeding twenty-four hours.

The following notes from Signal Service observers will show the severity of this storm:

Wash Woods, N. C., 1st: heavy surf; at 4.50 p. m. the bark "Ada Gray" went ashore near Little Island Life-Saving station. Crew of eleven men saved.

Atlantic City, N. J., 1st: warmer, with rain from early a. m. to 9 p. m., fol-

lowed by dense fog during the night. Storm southeast signal changed to storm northwest signal at 7.30 p. m. Southeast gale from 12.22 p. m. till 8.20 p. m., maximum velocity, thirty-six miles. Wind veered to the northwest in the evening, and decreased in force.

New London, Conn., 1st: the light snow which began on the 31st changed to rain at 2.30 a. m., and the snow on the ground was all melted before daylight. The rain continued incessantly during the entire day, and was quite heavy at 7 p. m. The total amount in twenty-four hours was 2.27 inches. The wind was high from the southeast, veering to south. Gale began 11 a. m. and continued till after midnight. The maximum velocity was forty miles per hour, at 6.30 p. m. Several vessels sought shelter in the harbor, but no damage was reported in this vicinity. The temperature is unusually high.

Narragansett Pier, R. I., 1st: light rain and southeast gale. Schooner "Mary A. Drury" ashore at Point Judith; fast rigging to pieces; will be a total loss. 2d, three masted schooner "Wm. H. Jordan," coal, from Baltimore for Bristol, R. I., struck on the rocks southwest side Block Island at 4.25 a. m. and sunk; crew took to rigging, and were rescued by Life-Saving crew.

Block Island, R. I., 1st: brisk and high southeast to southwest winds; temperature rose from $29^{\circ}7$ to 55° .

Eastport, Me., 2d: light rain changed to heavy at 12.10 a. m. and ended at 10.30 a. m. Order to hoist storm and southeast signal received 12.25 a. m. Gale began 4.03 a. m. and ended 5.10 a. m. Maximum velocity, thirty-six miles, from the south. No disasters reported.

II.—On the morning of the 1st this area of low pressure was central over Washington Territory, with lowest pressure, 29.68, at Spokane Falls. From this position it moved to the northeast, and at the succeeding observation was central north of Montana, the central pressure having declined to 29.4. It afterwards moved in a southeasterly direction and disappeared over the lower Missouri valley after 3 p. m. of the 2d by a gradual increase of pressure. It was attended by generally fair weather and increased temperature, which was very marked over the northern and middle slopes of the Rocky Mountains at midnight of the 1st and morning of the 2d, the change amounting to 40° in twenty-four hours.

III.—This area of low pressure first began to appear off the north Pacific coast at 3 p. m. of the 2d. It moved in a direction slightly south of east until midnight of the 3d, when it was central over Colorado, with lowest pressure bounded by the isobar of 29.4. From this position its centre moved back and forth from central Colorado to western Utah until the morning of the 6th, when it took a southeast course and disappeared, by a gradual increase of pressure, at midnight of the 6th over the southeast corner of New Mexico. It was accompanied by heavy rains on the 2d and 3d over the middle and south Pacific coast regions, light rains over the middle and southern plateaus on the 4th and 5th, and by light snows over the northern slope of the Rocky Mountains and the Missouri and upper Mississippi valleys on the 4th, 5th, and 6th.

IV.—This area of low pressure is apparently a portion of the preceding area which was detached on the night of the 5th by an area of high pressure then bearing down from the northwest. It was central over Indiana and Illinois during the 6th, after which it moved rapidly to the northeast and disappeared beyond the region of observation on the afternoon of the 7th. Precipitation was general over the upper Mississippi valley, the Ohio Valley, and the Lakes on the 6th and 7th, and over the New England and middle Atlantic states during the 7th.

V.—On the morning of the 11th a low pressure area was advancing over Montana from the northwest, and at the succeeding observation its centre was located to the north of Fort Assinaboine. It moved in a southeasterly direction until the morning of the 12th, when it was central near Cheyenne, Wyo., when the pressure was 29.44. The area was, in shape, an elongated ellipse, the major axis being north and south, and it covered all that portion of the United States between the ninety-second and one hundred and seventh meridians. Throughout this region snow prevailed, excepting in the southern portion of Texas, where rain occurred. In the eastern quadrants the wind blew from the south and southeast at a rate of from twenty to forty miles per hour, while in the western quadrants the wind blew from north to west with still greater force. During the 11th the temperature had risen throughout this area from 10° in the southern portion to 40° in the northern portion, but was still below zero in the extreme northwest and

near the freezing point in the middle and southern sections. At 3 p. m. of the 12th the storm was central near Omaha, Nebr., from which position it moved to the northeast and passed to the north of the region of observation after 3 p. m. of the 13th. As the storm advanced, with rising temperature and south to east winds in the eastern quadrants, the wind suddenly shifted to the northwest and blew with increased velocity in the western quadrants, while the temperature in the rear of the storm suddenly fell from 30° to 50°, which intensely cold wave accompanied an area of high pressure then advancing from the northwest.

VI.—This disturbance was observed moving from the north Pacific eastward, and was central over Washington Territory on the morning of the 12th. It moved to the southeast till central over Colorado, then to the south, and was last observed in southern New Mexico on the 14th. It was attended by light rains in the north Pacific region on the 12th and 13th.

VII.—This low pressure area apparently developed in the Ohio Valley on the morning of the 17th. The central pressure was bounded by an isobar of 30.4. It moved to the northeast with decreasing pressure until north of Lake Ontario, then to the southeast, passing off the coast of Massachusetts on the morning of the 18th, with lowest pressure, 29.64, at Block Island, R. I. Precipitation was general throughout the Ohio Valley, the Lake region, the middle Atlantic and New England states during the passage of this low area.

VIII.—This storm apparently advanced from the Pacific Ocean to the coast of Washington Territory, where it was central on the morning of the 23d. It moved across the continent in a direction slightly to the south of east until it reached the

Atlantic Ocean, after which it traveled to the northeast along the coast of New England and passed beyond the Maritime Provinces on the morning of the 27th. It was attended by light rains on the Pacific coast during the 23d, and by a decidedly warm wave over the northern and middle slopes of the Rocky Mountains and the Missouri Valley on the 24th, during which the rise in temperature was from 30° to 50° in twenty-four hours, with fair weather in all regions covered by the area on that date. On the morning of the 25th the storm was central over the Lakes, when light snow had set in, which during the day became general over the Ohio Valley, middle Atlantic, and New England states. The pressure at the centre began to decline rapidly, and when last observed it was 28.58 at Chatham, N. B. Violent gales prevailed on the middle Atlantic and New England coasts from midnight of the 25th till the morning of the 28th, the maximum velocity in many cases reaching sixty miles per hour.

IX.—This area of low pressure was first observed central over Washington Territory at 3 p. m. of the 25th. It moved in a direction slightly to the north of east, then to the southeast, and disappeared over Iowa, Illinois, and Missouri after 10 p. m. of the 26th, by a gradual increase of pressure. It was attended by fair weather and high temperatures, excepting on the north Pacific coast, where rains occurred.

X.—The approach of this low area was indicated by low readings of barometers over Manitoba, beginning on the morning of the 27th. The centre was first located to the north of Dakota at midnight of the 29th. It moved to the southeast with increasing pressure, attended by light winds and fair weather, passing to the ocean from the coasts of Virginia and North Carolina on the morning of the 31st.

NORTH ATLANTIC STORMS FOR JANUARY, 1888.

[*Pressure in inches and millimetres; wind-force by Beaufort scale.*]

The paths of the depressions that appeared over the north Atlantic Ocean during January, 1888, have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels, received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Nine depression are traced, of which six advanced eastward from the American continent north of the fortieth parallel; one developed over mid-ocean between the fortieth and forty-fifth parallels and moved east-northeast to the British Isles; one is given an approximated path from the vicinity of the Azores southwestward to the thirty-ninth meridian, and thence northward, and one passed south of east over the British Isles from the vicinity of the sixtieth parallel. With the exception of numbers 3, 6, and 7, the depressions pursued normal paths.

In January, 1887, twelve depressions were traced, of which seven passed northeastward over or near Newfoundland; four first appeared over mid-ocean, and one developed off the east coast of the United States. The depressions pursued east-northeast to northeast paths, and, being rather evenly distributed throughout the month, with tracks, as a rule, confined to territory north of the fiftieth parallel, caused a continuation of strong westerly gales in the trans-Atlantic routes.

In January, 1888, the depressions traced corresponded closely in number with the January average, and their passage was unattended by disturbances of unseasonable severity. The region of greatest storm frequency extended east-northeast from Newfoundland, and all depressions traced from the American coast disappeared to the northward of the region of observation between the twentieth and fortieth meridians. Two well-defined depressions advanced from the ocean over the British Isles, and two developed west of the Azores.

The month opened with an area of low pressure central northwest of Ireland, and moderate to fresh gales along the trans-Atlantic tracks to the Grand Banks. To the southward of Nova Scotia barometric maxima rising to about 30.50 (774.7)

were shown. During the 2d cyclonic disturbances continued over the British Isles, and unsettled weather and fresh to strong gales prevailed east of the fiftieth meridian. On the 3d two storms of marked energy, one of which had moved northeast over mid-ocean, and the other had advanced east over Newfoundland, dominated the weather conditions from coast to coast. By the 4th the barometric pressure had risen off the coasts of the United States, following the eastward movement of the depression central on the 3d off the Newfoundland coast. During the remainder of the first decade of the month there was a gradual increase in pressure over the British Isles, with fresh and brisk south to west winds; over mid-ocean barometric minima falling below 29.00 (736.6) attended the presence during the 5th and 6th of an area of low pressure central north of the fiftieth parallel; and from the 8th to the 10th, inclusive, storms of great violence were occasioned by a depression which moved northeast from Nova Scotia. During the second decade the barometer continued uniformly high over the British Isles. From the 15th to the 18th, inclusive, stormy weather prevailed west of the Azores, attending the presence in that region of a depression of considerable energy. The second decade was marked by the passage over Newfoundland and the western portion of the ocean of two depressions of great strength. During the last eleven days of the month no important disturbances occurred over the British Isles until the 31st, when the presence of a depression over the North Sea was indicated. Over mid-ocean moderate to fresh gales prevailed until the 26th, after which the pressure continued high with generally settled, fair weather. Over the western portion of the ocean stormy weather prevailed during the third decade, attending the passage of three depressions, two of which are traced over Newfoundland as ocean storms, and one, which advanced along the New England coast and over the Canadian Maritime Provinces during the 26th and 27th, is described under the heading "Areas of low pressure."

In the following descriptions of the depressions traced, posi-

tions are given in degrees latitude and longitude, except in cases where twenty-five to thirty-five minutes are cited, when they are shown in degrees and half degrees:

1.—This depression was central on the 1st between Iceland and Ireland, with central pressure below 29.00 (736.6); by the 2d it had apparently advanced to the vicinity of the Hebrides Islands, with fresh north to west gales to the thirtieth meridian; by the 4th the storm-centre had disappeared beyond the region of observation.

2.—This depression was central on the 1st in about N. 44°, W. 37°, with fresh to strong gales between the thirtieth and sixtieth meridians; by the 2d the storm-centre had moved slowly north of east to the forty-fifth parallel, with pressure falling to about 29.50 (749.3), whence it passed northeast to N. 52°, W. 25° by the 3d, with central pressure about 29.20 (741.7). By the 4th the centre of depression had advanced to the vicinity of Ireland, where values below 29.30 (744.2) were shown; after which it pursued a northerly path over the British Isles, and disappeared in the direction of the Norwegian coast after the 5th.

3.—This depression moved eastward from the Gulf of Saint Lawrence, and on the morning of the 3d was central off the northeast coast of Newfoundland, with pressure below 29.20 (741.7). By the 4th the storm-centre had advanced north of east to the forty-second meridian, with a marked decrease in barometric pressure, and by the 5th had passed northeast to about N. 55°, W. 38°, where central pressure below 29.00 (736.6) was shown. During the next twenty-four hours the depression recurred slightly to the southwestward without evidence of loss of energy, after which it moved eastward to the thirtieth meridian and disappeared north of the region of observation after the 7th. On the night of the 2d, a strong southerly gale, accompanied by snow and heavy rain, was reported by Mr. John Higgins, observer at Saint John's, N. F. The gale continued until 10 a. m. of the 3d, when it veered to northwest.

4.—This depression was central on the 8th south of Newfoundland, in N. 45°, whence it had advanced from the westward. By the 9th it had moved rapidly northeast to about N. 52°, W. 40°, with pressure below 29.00 (736.6), from which position it passed slowly northeast about three degrees by the 10th. At 12 noon, Greenwich time, of the 11th the storm was central in about N. 57°, W. 27°, and by the 12th had disappeared in the direction of Iceland.

5.—This depression passed eastward over the northern extremity of Newfoundland during the 11th, with central pressure below 29.40 (746.7), and by the 12th had advanced north of east to the forty-fifth meridian, after which it pursued an east-northeast track and disappeared north of the fifty-fifth parallel, attended throughout by strong gales.

6.—The presence of this depression southwest and west-southwest of the Azores was shown by reports of the 14th, 15th, 16th, and 17th, during which period fresh to strong gales and falling barometer prevailed in that region, with high barometric pressure to the east and northeast of the Azores. By the 18th the depression had moved northward to the forty-fifth parallel, attended by strong to whole gales, and minimum pressure about 29.20 (741.7), after which it apparently recurred westward under the influence of depression number 7, which had moved eastward from the middle Atlantic coast states.

7.—This depression was central on the 18th southwest of Nova Scotia, in about N. 41°, without evidence of marked energy, whence it advanced to the south of Newfoundland, in N. 44°, by the 19th, in which position barometric minima falling below 28.90 (734.0) were reported. By the 20th the depression had moved northward over Newfoundland, with an apparent increase in pressure, and by the 21st was central off the northeast coast of Newfoundland. During the next three days the centre of depression moved east-northeast, with a moderate display of energy, and subsequent to the 24th disappeared in the direction of Iceland.

8.—This depression moved eastward from Nova Scotia during the 24th, and by the 25th had advanced to the eastward

of Newfoundland, with pressure below 29.00 (736.6) and strong to whole gales. By the 26th the depression had moved northeast to the fortieth meridian, with a marked increase in central pressure, after which it disappeared north of the region of observation. Mr. John Higgins, observer at Saint John's, N. F., reports: "24, southeast gale sprang up 7 p. m., accompanied by snow; continued quite violent until 11 p. m., when sleet fell, changing into rain; barometer fell from 30.11 (764.8) in the morning to 28.94 (735.1) during the night; wind veered to northward and increased in force on the morning of the 25th."

9.—This depression was the continuation of an area of low pressure of great energy that passed along the New England coast during the 26th and advanced over the west portion of the Gulf of Saint Lawrence by the morning of the 27th. During the 28th the depression moved to the northward of Newfoundland beyond the region of observation.

OCEAN ICE.

On chart i the positions of icebergs reported during the month are shown by ruled shading. On the 31st the s. s. "Maine" passed two bergs, one very large, in N. 45° 20', W. 50° 01', and an ice bank was observed to the northward. In January, 1887, a medium sized berg was observed in N. 48° 30', W. 46° 00', on the 30th. In January, 1886, several icebergs were observed off the southeast coast of Newfoundland. In January, 1885, icebergs were reported between W. 45° 30' and W. 42° 24', none being observed south of the forty-seventh parallel. In this month they were observed eleven days earlier and were about four degrees farther eastward than those of January, 1884. In January, 1883, the first icebergs reported were observed in N. 47° 35', W. 45° 04' on the 30th, and in the corresponding month of 1882 the first icebergs were seen in N. 47° 30', W. 48° 35' on the 30th.

From the above it will be seen that while the quantity of ice observed during January, 1888, corresponded closely with the January average for the preceding six years, its position was nearly two degrees farther south and somewhat to the westward of the usual January ice limits. In but one other year, 1886, was ice reported as far west as the fiftieth meridian, and in 1886 and 1888, only, was it observed south of the forty-seventh parallel.

FOG.

The following are the limits of fog-areas on the north Atlantic Ocean during January, 1888, as reported by shipmasters:

Date.	Vessel.	Entered.			Cleared.		
		Lat. N.	Lon. W.	Time.	Lat. N.	Lon. W.	Time.
2	S. S. Iowa	43 00	63 57	Noon	42 32	66 30	11 p. m.
12	S. S. Philadelphia	36 41	72 27	.....	36 19	72 15	Midnight.
13	S. S. New York	35 34	75 11	10 p. m.	35 15	75 13	
14	S. S. Hibernian	Off Cape May.	4 a. m. to 5 p. m.	.....		
15	S. S. Carondelet	35 20	75 10	.....	36 56	74 55	
15-16	S. S. DeRuyter	49 57	37 18	9 a. m.	47 24	44 53	8 p. m.
15-16	S. S. Umlauf	40 47	68 34	5-30 p. m.	40 30	70 51	2 a. m.
16	S. S. Galileo	44 10	46 50	3 p. m.	44 08	47 48	7 p. m.
17-18	S. S. Italy	45 49	48 30	.....	45 50	47 20	
18	S. S. Concordia	45 10	47 43	6-30 a. m.	45 18	47 23	11 a. m.
18	S. S. Ems	45 08	47 00	10 a. m.	45 00	49 07	5 p. m.
19	S. S. Servia	45 08	45 19	6-30 a. m.	44 54	46 11	8-30 a. m.
19	S. S. Devonia	47 36	45 25	.....	46 25	48 00	
19	S. S. Palestine	48 35	43 24	8 a. m.	48 13	42 51	Noon.
19	S. S. Oregon	49 30	46 40	8 a. m.	49 22	47 50	2 p. m.
24	S. S. Australia	41 18	64 06	.....	41 08	66 23	
27	S. S. Lord Clive	44 10	51 30	Noon	43 56	52 40	8 p. m.
27	S. S. Surrey	44 55	49 15	.....	44 45	49 50	
27-28	S. S. Gallia	44 04	47 06	11-10 p. m.	43 26	50 20	9-20 a. m.
27-29	S. S. Tower Hill	45 50	46 00	.....	44 30	52 50	
28	Fog at Cape Race	.....				
28	S. S. Surrey	44 06	54 32	.....	44 05	54 45	
28	S. S. Mineola	40 30	43 40	8 p. m.	45 10	48 49	10-50 p. m.
28-29	S. S. Siberian	45 00	44 30	4 p. m.	43 30	50 10	1 p. m.
28-29	S. S. Bohemia	45 07	46 00	5-05 a. m.	43 48	53 35	2-05 p. m.
29	S. S. Belgenland	45 48	46 24	11-30 a. m.	44 05	49 15	11-15 p. m.
29	Fog at Cape Race	.....				
31	S. S. Cephalonia	44 47	47 32	8 a. m.	43 50	48 10	Midnight.
Feb. 1	S. S. Republic	46 06	47 20	.....	45 09	50 50	

The limits of fog-belts to the westward of the fortieth meridian are shown on chart i by dotted shading.

As compared with the chart of the preceding month, December, 1887, the eastern limit of the Newfoundland fog-belt has extended about five degrees, and the southern limit remains about the same. No isolated fog-area appears off the southeast edge of the Banks, however, as in December. To the southward of Nova Scotia fog was observed nearly three degrees farther south than in the preceding month, and on a corresponding number of dates, while along the coast of the United States fog-areas were encountered about three degrees farther south than during December.

On the dates for which fog was reported near Newfoundland the meteorological conditions were as follows: Although no fog was reported in this region until the 15th instant, the atmospheric conditions were apparently favorable for its precipitation on the 3d, 8th, and 11th. On the first mentioned date a barometric depression passed eastward north of the Banks, and the non-development of fog was probably due to unusual influences exerted by an area of low pressure which moved northeastward east of the Banks during the first three days of the month, causing northwesterly winds over the fog-region until the immediate presence of the depression which

advanced from the westward. On the 7th and 8th similar conditions prevailed. On the 11th the conditions were favorable for fog, although none has been reported. During the 15th, 16th, and 17th fog was encountered off the eastern edge of the Banks, with easterly winds attending the presence to the southward of an area of low pressure. During the 18th and 19th the passage of a barometric depression from the middle Atlantic coast to Newfoundland caused south to southeast winds and fog over the Banks. On the 24th the conditions were favorable for fog, but none has been reported. During the 27th, 28th, and 29th the presence of a depression over the Gulf of Saint Lawrence caused southerly winds and fog, and on the 31st south to southeast winds and fog were reported off the eastern edge of the Banks. On the two dates, the 2d and the 24th, for which fog was reported south of Nova Scotia, the barometric pressure was low and southerly winds prevailed, attending the presence over Nova Scotia or New Brunswick of areas of low pressure. For the five dates, from the 12th to 16th, inclusive, on which fog was reported off the coast of the United States, the winds were variable or anti-cyclonic, and the barometric pressure abnormally high.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for January, 1888, is exhibited on chart ii by dotted isothermal lines. In the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature, precipitation, and departures from the normal, show respectively the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal, and subtracting when above.

In the middle and southern Rocky Mountain slopes, the south Atlantic and east Gulf states, and in the eastern part of the west Gulf states, the month of January was warmer than the average, but the departures from the normal temperature in the districts named did not exceed 4° and at most stations were less than 2°.

In all other districts the month was colder than the average, and it may be rated as an exceptionally cold one throughout the northern portions of the country. In New England, the upper Mississippi and Missouri valleys, and in the northern and middle plateau districts, the departures from the normal temperatures ranged from 8° to 12°, and these marked departures are shown by comparison with normals of the oldest established stations of the Signal Service. North of the fortieth parallel the deficiencies in the mean temperatures have nowhere been less than 4°, except over portions of the eastern slope and the Lake region and in the upper Ohio valley.

The following are the most marked departures from normal temperatures at Signal Service stations:

Above normal.	Below normal.
Pensacola, Fla.....	3.8
Las Animas, Colo.....	3.6
Montgomery, Ala.....	3.1
Atlanta, Ga.....	3.0
Fort Davis, Tex.....	3.0
Santa Fe, N. Mex.....	2.7
Cedar Keys, Fla.....	2.3
Chattanooga, Tenn.....	2.1
Winnemucca, Nev.....	0
Helena, Mont.....	12.3
La Crosse, Wis.....	11.7
Davenport, Iowa.....	11.4
Des Moines, Iowa.....	11.3
Saint Paul, Minn.....	10.9
Boise City, Idaho.....	10.3
Dubuque, Iowa.....	10.0

RANGES OF TEMPERATURE.

The monthly and the greatest and least daily ranges of temperature at Signal Service stations are given in the table of miscellaneous meteorological data, and the extremes below. As usual the ranges were greatest over the region between the Mississippi and the Rocky Mountains. They vary from 75° to 105° in the upper Mississippi and Missouri valleys and in the

northern and middle Rocky Mountain districts; the least monthly ranges occur along the Pacific coast, where they generally vary from 30° to 40°.

Greatest.	Least.
Fort Larainie, Wyo.....	105.5
Poplar River, Mont.....	100.8
North Platte, Nebr.....	100.8
Fort Custer, Mont.....	99.1
Fort Maginnis, Mont.....	99.0
Denver, Colo.....	96.3
Rapid City, Dak.....	95.7
Key West, Fla.....	22.5
San Diego, Cal.....	31.5
San Francisco, Cal.....	34.1
Fort Bowie, Ariz.....	39.8
Los Angeles, Cal.....	40.1
Tatooch Island, Wash.....	41.4
Port Angeles, Wash.....	42.0

The greatest daily range of temperature for the whole country was 66°.5 at Helena, Mont., and the least 1°.8 at Shreveport, La. Daily ranges exceeding 60° occurred at Fort Maginnis, Helena, and Poplar River, Mont., Denver, Colo., and Abilene, Tex.; daily ranges of 3° or less occurred at Albany, N. Y., Leavenworth, Kans., Galveston, Tex., Shreveport, La., Pike's Peak, Colo., and Astoria, Oregon.

LOW TEMPERATURES.

The following notes on the extremely low temperatures of January have been received:

California.—Sacramento: a minimum temperature of 19° was recorded on the 14th; this is the lowest recorded since the establishment of the Signal Service station on July 1, 1877, and it is also the lowest known since January 21, 1854, when a similar temperature was observed by Dr. Logan. Between the 15th and 18th ice on streams, etc., was sufficiently strong to bear the weight of persons, an unusual occurrence for this region.

Georgetown, El Dorado Co.: the minimum temperature on the 14th, 11°, was the lowest ever known to have occurred at this place. Rose bushes that had been set out for the last twenty years and that were never before injured had their foliage completely destroyed.

Fort Bidwell: the lowest temperature ever known at this place occurred between 4 and 6 a. m. on the 14th, when a minimum of -26° was recorded.

San Francisco: a minimum temperature of 20° was recorded on the morning of the 15th, it being 4° lower than any previously observed at this place since the establishment of the Signal Service station in March, 1871. Ice formed to a thickness of four inches.

Willows, Colusa Co.: the night of the 15th was the coldest experienced during the last fourteen years.

Dr. J. B. Trembley, of Oakland, reports: "the weather from the 8d to the 18th was the coldest ever observed by American settlers in California."

Nicolaus, Sutter Co.: the unusually cold weather during the month caused much damage to plants and trees.

Idaho.—Boisé City: the minimum temperature on the 15th, -26°, is the lowest recorded at this place since the establishment of the Signal Service station in 1877; the loss of live stock on account of cold weather is already considerable; the frozen streams deprive the cattle of drinking water.

Iowa.—Mr. J. P. Walton, Muscatine, Muscatine Co., furnishes the following: "My meteorological record reaches back fifty years—to January 1, 1839. January 15, 1888, as a whole, was the coldest on record. Below is given a table showing the five coldest days for the period named:

Date.	Morning.	Noon.	Night.	Mean.
January 18, 1887	°	°	°	-18
February 10, 1888	-32.0	-5	-11	-11
January 28, 1885	-34.5	-2	-2	-12
January 7, 1887	-23.0	-4	-2	-8
January 15, 1888	-24.0	-11	-30	-21

"Note.—On the night of January 6-7, 1887, the temperature fell to -30°."

Dr. Gustavus Hinrichs, Iowa City, furnishes the following, dated 21st:

"The continued extremely cold weather that has prevailed during the past ten days is very remarkable, and fortunately a rare feature in Iowa climatology. During the entire middle decade of January, 1888, the temperature has been zero, or below, on every night, on two of which it reached to within one and two degrees of the lowest temperature recorded by me in almost twenty years.

"The mean temperature of the second decade of January, 1888, is -4°. Only once during the twenty-eight years for which we have an unbroken series of reliable observations at Iowa City has any winter decade been as cold, namely, the first decade of January, 1864, which had a mean temperature of -7°, according to Professor Parvin's observations. Accordingly the second decade of January, 1888, and the first decade of January, 1864, have been the coldest ten-day periods in the history of Iowa for almost thirty years.

"It is extremely rare in Iowa for a decade to have a mean temperature below zero; we find but three other cases on record, namely, the first decade of January, 1879, -1°; the first decade of January, 1884, -2°; and the second decade of February, 1885, -2°. It will thus be noticed that during the twenty-eight years of observation at Iowa City there have been only five decades having a mean temperature of zero, or below.

"During the first eighteen years only one winter decade was so extraordinarily cold, but during the last ten years we have had four such instances. Reduced to equal length of time, this shows that such extreme cold has been seven times as frequent during the latter than during the former years of observation. This is another indication of the fact which I have repeatedly stated, namely, that in Iowa the winters are colder than formerly."

Minnesota.—Saint Paul: the daily mean temperature of the 15th, -28°, is 5° below the lowest recorded since establishment of station in 1870.

Nebraska.—Genoa, Nance Co.: the lowest temperature on record for the last fifteen years, -32°, occurred on the 15th.

Oregon.—Portland: the minimum temperature on the 15th, -2°, is the lowest recorded during the last sixteen years.

Roseburg: unusually low temperatures occurred on the 14th, 15th, and 16th; the minimum, -6°, on the 16th, was the lowest recorded since the establishment of the Signal Service station in 1878. The cold weather caused great suffering to stock.

Linkville: the lowest temperature ever known here, -15°, occurred on 7th.

Texas.—Brownsville: a minimum temperature of 23° was recorded on the 22d; this is the lowest since December 31, 1880, and January 1, 1881, when the minimum temperature of 18° was noted.

Fort Elliott, 15th: lowest temperature since establishment of station recorded this a. m., -14°.2.

Abilene, 15th: at 7 a. m. the minimum thermometer registered 5° below zero, which is the coldest of which there has been any record, and colder than the oldest residents have ever known it.

Utah.—Salt Lake City: a minimum temperature of -17° was recorded on the 15th; this was the lowest on record since the establishment of the Signal Service station in 1874, with one exception, viz., -20° in January, 1883. The extremely cold weather of the second decade resulted in the loss of large numbers of sheep in the western part of the territory. The mean temperature for the first twenty days of this month is 16°, the lowest ever noted at this station, and is 12° below the normal for the last thirteen years. The following table shows the mean temperature for the first and second decades of January of each year since the establishment of the signal station here:

Year.	First decade.	Second decade.	Average.	Year.	First decade.	Second decade.	Average.
1875	°	°	°	1883	°	°	°
1876	30.6	29.1	29.8	1884	26.5	16.1	21.3
1877	34.3	27.2	30.8	1885	32.2	22.8	27.5
1878	33.4	26.8	31.1	1886	31.0	27.9	29.4
1879	21.9	30.2	26.0	1887	32.4	34.6	33.5
1880	26.2	26.4	26.3	1888	21.6	28.1	22.4
1881	31.5	31.2	31.4	1889	21.6	9.4	15.5
1882	45.5	36.4	31.0	Normal for 13 years	28.8	27.2	28.0

Washington.—Spokane Falls: a minimum temperature of -30° occurred on the 16th; this is the lowest on the records of the signal office, established in February, 1881.

FROST.

Frosts were of almost daily occurrence throughout the northern portions of the country. In the south Atlantic states they occurred from the 2d to 4th, 11th to 13th, 17th to 20th, 22d, and from the 26th to the 29th; in Florida, 3d, 18th, 19th, 20th, 26th, 27th, 29th, 30th; east Gulf states, 2d to 4th, 14th, 19th,

20th, 24th to 29th; west Gulf states, 1st, 3d, 7th to 24th, 26th to 29th; lower Rio Grande valley, at Rio Grande City, 2d, 15th to 17th, 19th.

DEVIATIONS FROM NORMAL TEMPERATURES.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperatures for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for January, 1888; (4) the departures of the current month from the normal; (5) and the extreme monthly means for January during the period of observations and the year of occurrence:

State and Station.	County.	(1) Normal for the month of Jan.	(2) Length of record.	(3) Mean for January, 1888.	(4) Departure from normal.	(5) Extreme monthly mean temperature for January.	
						Highest.	
						Am't.	Year.
Arkansas.		°	Years	°	°	°	
Lead Hill	Boone	30.2	6	31.9	+1.7	37.4	1882
California.						24.2	1886
Sacramento	Sacramento	46.1	22	39.4	-6.7	54.5	1873
Salinas	Montgomery	47.0	16	44.9	-2.1	52.4	1877
Santa Barbara	Santa Barbara	53.4	5	49.0	-4.4	42.1	1883
Connecticut.							
Southington	Hartford	13.1	19	19.5	+6.4	20.4	1870
Florida.	Brevard	59.6	5	63.4	+3.8	64.8	1885
Merritt's Island						55.3	1886
Illinois.							
Aurora	Kane	16.5	9	8.3	-8.2		
Collinsville	Madison	25.0	8	22.8	-2.2		
Golconda	Pope	31.2	9	29.6	-1.6		
Greenville	Bond	27.5	9	21.6	-5.9		
Mattoon	Coles	24.3	8	23.0	-1.3		
Prairieville	Lee	16.1	9	11.1	-5.0		
Peoria	Peoria	24.0	32	18.5	-5.5		
Riley	McHenry	17.2	25	8.1	-9.1		
Rockford	Winnebago	16.0	16	9.1	-6.9	33.9	1880
Sycamore	De Kalb	13.7	7	10.3	-3.4	6.6	1875
Indiana.							
Connersville	Fayette	22.6	6	25.0	+2.4		
Lafayette	Tippencanoe	22.3	9	18.6	-3.7		
Logansport	Cass	25.0	34	20.0	+5.0	43.0	1880
Mauzy	Rush	21.1	8	21.9	+0.8	10.5	1875
Spiceland	Henry	26.0	34	24.5	-1.5		
Summan	Ripley	23.5	5	25.3	+1.8	26.1	1887
Vevay	Switzerland	31.4	21	29.9	-1.5	20.2	1884
Worthington	Greene	25.6	6	21.9	-1.7		
Iowa.							
Independence	Buchanan	13.2	13	4.8	-8.4		
Cresco	Howard	8.9	16	0.8	-9.7		
Monticello	Jones	14.8	34	6.7	-8.1	32.9	1880
Kansas.						3.6	1875
Independence	Montgomery	27.8	17	24.4	-3.4	45.8	1880
Wellington	Sunman	25.0	10	23.0	-1.4	40.4	1880
Yates Centre	Woodson	22.3	8	29.9	-1.4	35.9	1880
Louisiana.							
Point Pleasant	Tensas	46.7	8	45.0	-1.7		
Grand Coteau	Saint Landry	50.2	6	51.6	+1.4		
Mandeville	S. Tammany	49.3	4	53.2	+3.9		
Maine.							
Gardiner	Kennebec	17.6	52	12.3	-5.3		
Maryland.	Cumberland	30.5	16	26.6	-3.9	39.0	1880
Massachusetts.	Alleghany	30.5	16	26.6	-3.9	39.0	1880
Somerset	Bristol	26.2	18	19.4	-6.8		
Michigan.	Kalamazoo	21.2	13	16.5	-4.7	36.3	1880
Nevada.	Carson City	32.0	9	26.7	-5.3		
New Jersey.	Burlington	26.8	25	25.4	-3.4	38.7	1880
Moorestown	Tioga	20.4	6	18.3	-1.9	22.7	1887
New York.	North Volney	21.2	20	14.1	-7.1	31.8	1880
Factoryville	Owego	20.6	35	11.6	-9.0	39.3	1883
Palermo						11.6	1887
Ohio.							
North Lewisburg	Champaign	23.8	57	24.1	+0.3		
Wauseon	Fulton	18.0	18	17.5	-5.0	37.7	1880
Tiffin	Seneca	22.2	3	22.5	+0.3	33.7	1887
Oregon.						20.5	1886
Albany	Linn	38.3	9	33.9	-4.4	43.8	1887
Eola	Polk	37.2	18	31.8	-5.4		
Pennsylvania.							
Corry	Erie	19.6	8	17.9	-1.7	23.9	1882
Dyberry	Wayne	20.7	24	15.5	-5.2	30.7	1880
Wellisborough	Tioga	24.2	10	20.0	-3.6	35.2	1880
South Carolina.							
Stateburg	Burner	44.1	7	46.0	+1.9	49.4	1882
Tennessee.	Milan	33.0	6	35.0	+2.0		
Texas.	Gibson	50.0	16	46.5	-3.5	63.7	1880
New Ulm	Austin	26.5	18	36.4	-3.1	49.4	1882
Virginia.						43.1	1881
Bird's Nest	Northampton	39.5	18	36.4	-3.1	49.4	1880
Dale Enterprise	Rockingham	28.8	8	34.0	+3.2	34.7	1880
Variety Mills	Nelson	24.0	11	32.2	-1.8	44.9	1880
Wytheville	Wythe	34.7	23	35.2	+4.4	41.0	1876
West Virginia.						29.1	1886
Helvetica	Randolph	32.2	12	32.8	+0.6	43.1	1880

Table of comparative maximum and minimum temperatures for January.

State or Territory.	Stations.	For 1888.		Since establishment of station.			Length of record.
		Max.	Min.	Max.	Year.	Min.	
Alabama.....	Mobile	73.7	23.0	78.0	1882	11.0	1886 18
Do.....	Montgomery	76.0	17.5	78.5	1882	5.4	1886 16
Arizona.....	Yuma	78.6	27.0	80.0	1879	22.5	1883 13
Do.....	Fort Grant	66.6	19.2	77.0	1879	10.0	1883 9
Arkansas.....	Fort Smith	71.0	1.2	73.7	1887	6.9	1886 6
Do.....	Little Rock	75.0	7.0	78.0	1880	4.8	1878 9
California.....	Los Angeles	71.0	30.9	82.0	1883	30.0	1880 11
Do.....	San Francisco	62.8	28.9	72.9	1887	36.0	1876, 1883 17
Colorado.....	Denver	76.0	-20.3	67.0	1882	-29.0	1875 17
Do.....	Pike's Peak	25.3	-22.8	30.0	1879	-37.0	1883 15
Connecticut.....	New Haven	53.2	-4.4	63.0	1876	-14.0	1873 16
Dakota.....	Bismarck	40.0	-37.0	49.0	1880	-43.6	1887 14
Do.....	Deadwood .....	.....	63.0	88.3	1883	-30.0	1883 11
Dist. of Columbia.....	Washington City	53.5	9.2	71.0	1874, 1876	-14.0	1881 18
Florida.....	Cedar Keys	77.0	29.3	77.0	1880	15.5	1886 9
Do.....	Pensacola	71.0	26.1	73.6	1882	14.9	1886 9
Georgia.....	Augusta	77.8	22.6	79.0	1879	6.0	1886 16
Idaho.....	Boise City	61.2	-27.8	61.5	1884	-27.0	1883 11
Illinois.....	Cairns	72.6	-0.3	70.0	1880	-16.0	1884 17
Do.....	Chicago	43.6	-16.8	65.0	1876	-20.0	1875 16
Indiana.....	Indianapolis	59.8	-6.0	69.0	1876	-25.0	1884 15
Indian Ter.....	Fort Sill	71.0	-7.2	75.9	1887	-9.0	1879 10
Iowa.....	Dubuque	37.0	-30.5	62.0	1874	-31.5	1887 15
Kansas.....	Des Moines	43.8	-27.4	63.0	1880	-30.4	1884 10
Do.....	Dodge City	69.0	-18.0	72.9	1887	-20.0	1883 14
Kentucky.....	Leavenworth	54.9	-21.1	65.0	1876	-29.0	1873 17
Louisiana.....	Louisville	69.0	-7.9	71.0	1876	19.5	1884 16
Do.....	New Orleans	79.6	26.8	78.0	1879, 1887	15.3	1886 18
Do.....	Shreveport	75.5	13.0	78.0	1876, 1880	-1.3	1886 15
Maine.....	Eastport	46.8	-12.3	51.0	1874	-20.0	1874 15
Do.....	Portland	46.7	-12.3	56.0	1876	-14.7	1887 17
Maryland.....	Baltimore	49.0	9.2	71.0	1876	-6.0	1881 16
Massachusetts.....	Boston	57.0	-6.3	69.5	1876	-13.0	1882 15
Michigan.....	Marquette	29.4	-21.2	56.0	1880	-26.0	1881 14
Do.....	Grand Haven	40.0	-5.2	57.0	1880	-12.0	1873 16
Minnesota.....	Saint Vincent	36.0	-53.5	39.0	1885	-46.0	1885 8
Do.....	Saint Paul	34.0	-41.2	49.0	1879	-35.7	1887 17
Mississippi.....	Vicksburg	77.8	17.5	80.0	1879	-3.1	1886 16
Missouri.....	Saint Louis	67.8	-11.5	72.0	1880	-21.5	1884 18
Montana.....	Ft. Assinaboine	53.3	-35.0	46.1	1885, 1886	-49.3	1886 8
Do.....	Helena	56.5	-41.0	57.0	1885	-34.0	1883 8
Nebraska.....	North Platte	66.2	-34.6	70.0	1886	-26.8	1885 14
Nevada.....	Omaha	51.3	-25.2	63.0	1879, 1880	-32.0	1884 16
New Hampshire.....	Winnemucca	49.6	-25.8	57.2	1887	-23.0	1883 9
New Jersey.....	Mt. Washington	42.0	-17.4	57.0	1874	-50.0	1885 17
New Mexico.....	Atlantic City	53.4	2.5	64.0	1880	-3.0	1875 15
New York.....	Santa Fe	57.5	-2.0	76.0	1879	-13.0	1883 16
Do.....	Buffalo	49.0	-6.0	65.5	1874	-13.5	1884 16
North Carolina.....	New York City	54.2	1.9	64.0	1876, 1880	-6.0	1886 17
Do.....	Charlotte	72.8	17.2	71.0	1885	-6.6	1886 10
Ohio.....	Wilmington	73.1	20.0	77.0	1879	9.0	1884 18
Do.....	Cincinnati	64.2	6.0	69.0	1876	-12.4	1886 18
Oregon.....	Sandusky	54.0	-1.6	64.0	1880	-16.5	1879 11
Do.....	Portland	62.0	-2.0	60.0	1886	3.0	1875 15

Table of comparative maximum and minimum temperatures, &c.—Cont'd.

State or Territory.	Stations.	For 1888.		Since establishment of station.			Length of record.
		Max.	Min.	Max.	Year.	Min.	
F'rs.	Do	71.1	-6.0	66.0	1885	12.0	1883 11
Pennsylvania.....	Pittsburg	61.0	3.0	75.0	1874	-12.0	1875 18
Do.....	Philadelphia	56.2	2.4	67.0	1876	-5.0	1875 18
Rhode Island.....	Block Island	55.0	-3.0	58.8	1885	-4.0	1882 8
South Carolina.....	Charleston	76.0	26.0	80.0	1879	-10.5	1886 15
Tennessee.....	Knoxville	70.3	12.2	74.0	1876	-16.0	1884 18
Do.....	Memphis	74.5	6.2	73.0	1876, 1880	8.0	1886 16
Texas.....	Brownsville	77.0	21.4	87.6	1887	18.0	1881 13
Do.....	Fort Elliott	77.1	-14.2	81.0	1886	-12.0	1883 9
Utah.....	Salt Lake City	52.8	-16.7	54.0	1879	-20.0	1883 14
Virginia.....	Lynchburg	73.7	14.0	72.0	1879	-4.0	1877 15
Do.....	Norfolk	73.4	16.2	80.0	1871	8.0	1879 18
Washington.....	Spokane Falls	51.3	-30.5	51.2	1887	-27.7	1883 7
Do.....	Olympia	56.0	-1.8	59.0	1885	9.0	1883 11
Wisconsin.....	La Crosse	34.0	-42.0	59.0	1874	-43.0	1873 16
Do.....	Milwaukee	36.7	-22.7	59.0	1871, 1874	-25.0	1875 18
Wyoming.....	Cheyenne	63.6	-37.2	63.0	1880	-38.0	1875 15

TEMPERATURE OF WATER.

The following table shows the temperature of the sea-water for January, 1888, observed, under conditions as given, at the harbors of the several stations; the monthly range of water temperature; the average depth at which the observations were made, and the mean temperature of the air:

Station.	Temperature at bottom.				Mean temperature of air at the station.	Average depth of water in feet and tenths.
	Max.	Min.	Range.	Monthly mean.		
Canby, Fort, Wash.*	69.5	52.4	17.1	60.5	59.3	7.4
Cedar Keys, Fla	16	55.5	48.5	7.0	51.0	35.4
Charleston, S. C.	17	50.0	58.8	19.6	49.7	14.8
Eastport, Me	40.4	34.2	6.2	37.0	13.7	16.6
Galveston, Tex	58.4	36.8	21.6	49.5	49.8	18.7
Key West, Fla	75.2	70.3	5.2	73.7	71.8	13.7
New York City	70.4	30.2	6.2	33.3	25.9	17.2
Pensacola, Fla	63.6	54.8	8.8	57.7	55.8	17.2
Portland, Me .....	.....	.....	.....	.....	.....	.....
Portland, Oregon ?	44.6	32.0	12.6	37.5	30.0	56.0

* Not received. ? Thermometer out of order. 231 days; river frozen from 15th to 24th, both inclusive.

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for January, 1888, as determined from the reports of about eight hundred stations, is exhibited on chart iv. In the table of miscellaneous meteorological data are given, for each Signal Service station, the total precipitation, with the departures from the normal. The figures opposite the names of the geographical districts in columns for mean temperature, precipitation, and departures from the normal, show respectively the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal, and subtracting when above.

In New England, the middle Atlantic and west Gulf states, and in the upper Mississippi, Missouri, and Ohio valleys, the rainfall of January, 1888, was about normal; it was slightly below normal in the Lake region and Rio Grande Valley, and decidedly below in the Florida Peninsula, south Atlantic and east Gulf states. On the Pacific coast the rainfall was above the normal, the most marked excess occurring in southern California, where the normal was exceeded by about 80 per cent. In the south Atlantic and east Gulf states only about 65 per cent. of the normal amount fell, and in the Florida Peninsula less than 20 per cent. of the normal amount fell. In northwestern California the monthly rainfall was very heavy, several voluntary observers in Humboldt county reporting more than 12 inches. Mr. W. H. Roscoe, voluntary observer at Upper Mattole, in the county named, reports a

monthly rainfall of 41.63, of which about 32 is reported to have fallen in the last six days of the month, more than 10 inches being recorded on one day, the 30th. The record from Upper Mattole shows that rain fell daily from the 1st to the 6th and from the 20th to the 31st, also on the 13th and 14th. Concerning this remarkably heavy rainfall, the following extract is given from a communication received from Lieutenant J. E. Maxfield, Signal Corps, San Francisco, Cal.:

This report shows the enormous rainfall of 41.63 inches for the month, a larger rainfall than any contained in the records of this office for points along the coast which ordinarily show a very large rainfall. The rainfall reports for January from stations near Upper Mattole have been examined and they all show an excessive rainfall. There is, therefore, no reason to doubt the correctness of Mr. Roscoe's record. Upper Mattole is in Humboldt county, near the coast, and its topographical surroundings are favorable for a heavy rainfall.

The records at the stations in northwestern California are not of sufficient length from which to compute normals, and, therefore, no comparison can be made, but the rainfall in that region for the month was, doubtless, largely in excess of the average.

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for a series of years; (2) the length of record during which the observations have been taken, and from which the average has been computed; (3) the total precipitation for January, 1888; (4) the departures of the current month from the average;

(5) and the extreme monthly precipitation for January during the period of observations and the year of occurrence:

State and station.	County.	(1) Average for the month of Jan.	(2) Length of record.	(3) Total for Jan., 1888.	(4) Departure from average.	(5) Extreme monthly precipitation for January.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
Arkansas.									
Lead Hill.	Boone	Inches 2.39	Years 6	Inches 2.54	+0.15	Inches 3.37	1882	Inches 1.33	1887
California.									
Sacramento.	Sacramento	4.24	22	5.37	+1.13	8.70	1875	1.07	1887
Santa Barbara.	Santa Barbara	3.70	20	10.15	+6.45	14.84	1875	0.25	1870
Connecticut.									
Southington.	Hartford	3.82	19	4.53	+0.71	6.47	1874	1.47	1876
Florida.									
Merritt's Island.	Brevard	2.50	10	0.74	-1.76	6.09	1883	0.57	1884
Illinois.									
Golconda.	Pope	3.60	9	3.75	+0.15	.....	.....
Mattoon.	Coles	2.42	8	2.65	+0.23	.....	.....
Peoria.	Peoria	1.63	32	1.87	+0.24	.....	.....
Riley.	McHenry	1.95	27	1.24	-0.71	.....	.....
Indiana.									
Logansport.	Cass	1.96	34	3.50	+1.54	4.97	1870	0.00	1886
Spiceland.	Henry	2.85	28	2.30	-0.55	7.30	1876	1.10	1878
Sunman.	Ripley	3.79	5	2.83	-0.90	7.48	1885	2.00	1884
Iowa.	Switzerland.	4.29	21	4.20	-0.09	9.03	1876	1.61	1879
Kansas.									
Independence.	Buchanan	1.38	12	1.49	+0.11	3.69	1886	0.20	1878
Cresco.	Howard	1.31	15	1.74	+0.43	.....	.....
Monticello.	Jones	1.65	34	1.13	-0.52	3.77	1866	0.29	1865
Louisiana.									
Independence.	Montgomery	1.52	16	1.28	-0.24	2.69	1878	0.30	1875
Wellington.	Sunman	0.71	10	0.65	-0.06	1.54	1886	0.18	1881
Yates Centre.	Woodson	1.00	8	1.60	+0.60	1.80	1885	0.19	1881
Ohio.									
Point Pleasant.	Tensas	6.78	8	2.30	-4.48	.....	.....
Grand Coteau.	Saint Landry	7.12	6	2.70	-4.42	.....	.....
Mandeville.	St. Tammany	5.88	4	3.27	-2.61	.....	.....
New Iberia.	Iberia	4.70	4	2.39	-2.31	.....	.....
Maine.									
Gardiner.	Kennebec	3.51	50	5.13	+1.62	.....	.....
Maryland.									
Cumberland.	Alleghany	2.20	16	3.85	+1.65	3.90	1878	0.30	1887
Michigan.									
Kalamazoo.	Kalamazoo	2.37	13	1.89	-0.48	.....	.....
Nevada.									
Carson City.	Ormsby	1.96	9	1.54	-0.42	5.57	1886	0.40	1885
New Jersey.									
Moorestown.	Burlington	3.49	25	4.44	+0.95	5.82	1882	1.13	1867
New York.									
Factoryville.	Tioga	2.18	6	2.51	+0.33	3.42	1886	1.20	1887
Palermo.	Owego	3.31	35	3.53	+0.22	5.30	1874-75	2.00	1882
Ohio.									
North Lewisburg.	Champaign	3.63	17	6.15	+2.52	8.67	1876	0.44	1877
Wauseon.	Fulton	2.21	14	2.40	+0.19	3.53	1880	1.29	1879
Tiffin.	Seneca	2.51	3	2.77	+0.26	3.03	1886	1.75	1887
Oregon.									
Albany.	Linn	8.21	9	10.71	+2.50	12.58	1887	2.22	1882
Pennsylvania.	Polk	6.34	18	11.68	+5.34	.....	.....
Corry.	Erie	3.59	3	3.32	-0.27	4.61	1886	2.84	1887
Dyberry.	Wayne	3.06	19	4.38	+1.30	4.75	1878	0.50	1872
South Carolina.									
Stateburg.	Sumter	3.72	7	2.14	-1.58	6.04	1885	2.14	1888
Tennessee.									
Milan.	Gibson	5.66	6	6.03	+0.37	7.50	1885	4.45	1884
Texas.									
New Ulm.	Austin	4.04	16	2.75	-1.29	10.56	1882	1.09	1887
Vermont.									
Stratford.	Orange	3.27	13	3.80	+0.53	5.50	1887	1.70	1878
Virginia.									
Bird's Nest.	Northampton	3.68	19	4.10	+0.42	6.75	1882	1.00	1876
Dale Enterprise.	Rockingham	2.52	8	1.92	-0.60	5.90	1886	1.13	1883
Variety Mills.	Nelson	4.03	9	2.92	-1.11	6.14	1882	1.58	1880
Wytheville.	Wythe	3.56	22	3.25	-0.31	7.08	1882	1.50	1872
West Virginia.									
Helvetia.	Randolph	5.31	12	4.32	-0.99	.....	.....

SNOW.

Light or heavy snow fell in some part of the lower lake region on every day during the month, and in all northern districts snow was of frequent occurrence. None fell in the east Gulf states during January, excepting the 2d and 16th in the northern portion; in the west Gulf states it was reported on the 8th, 9th, 12th, 14th to 17th, 23d, and 27th; in the lower Rio Grande valley on the 15th and 16th; in the south Atlantic states on the 12th, 13th, 16th, 17th, 18th, 21st, and 22d. In Dakota, Minnesota, Wisconsin, Michigan, and western New York the heavy snowfalls during the month, with the extremely cold weather, resulted in extensive blockades, which greatly impeded railway traffic. The severest snow storms of the month in the Northwest occurred on the 6-7th and 12-16th, and in western New York on the 26-27th.

MONTHLY SNOWFALLS (in inches and tenths).

In the northern portions of Maine, Vermont, New Hampshire,

and Michigan, in western New York, and in western and northwestern Pennsylvania the monthly snowfalls generally ranged from 30 to 50 inches, the largest amount being 59 at Lewiston, Me. With the exception of West Virginia, Maryland, northern Virginia, and portions of Tennessee and Arkansas, the monthly snowfalls were generally less than 4 inches in all districts south of the thirty-seventh parallel to the east of the one hundredth meridian. Reports from stations along the line of the Central Pacific Railway, in Placer and Nevada counties, California, show very heavy snowfalls, but these are not unusual for that region in January.

The following monthly snowfalls of ten inches or more occurred; but in states having less, the maximum amount is also given:

Arizona: Prescott, 13; Fort Apache, 11.6. *Arkansas:* Little Rock, 11.1. *British Columbia:* New Westminster, 19. *California:* Summit, 92; Cisco, 69; Emigrant Gap, 38; Towles, 25; Truckee, 23.5; Colfax, 18; Fort Bidwell, 17.2; Tehachapi, 12; Delta, 10. *Colorado:* Aspen, 20; Grand Junction, 10. *Connecticut:* New Hartford, 25.8; Middletown, 21.5; Southington, 19.5; Hartford, 17.1; Waterbury, 15; New Haven, 14.6; New London, 10. *Dakota:* Webster, 18; Richardson, 17.5; Yankton, 16.8; Bismarck, 11.2. *District of Columbia:* Washington City, 7.8. *Idaho:* Boise City, 6.6. *Illinois:* Oswego, 12.2; Rockford, 12; Chicago, 11.7; Sandwich, 10.5. *Indiana:* Delphi, 15.3; Angola, 13.2; La Grange, 12.1; Princeton, 11; Columbia City, 10. *Indian Territory:* Tulsa, 3.5. *Iowa:* West Bend, 16.9; Des Moines, 14; Davenport, 11.4; Dysart, 10.5; Cresco, 10. *Kansas:* Cawker City, 7.5. *Kentucky:* Lexington, 4.1. *Louisiana:* Coushatta, 7 to 8. *Maine:* Lewiston, 59.4; Portland, 41.6; Gardiner, 41.5; Bar Harbor and Cornish, 38; Orono, 37.5; Skowhegan, 32.8; Eastport, 21.9. *Maryland:* New Midway, 12; Cumberland, 11; Fallston, 10.5. *Massachusetts:* Fitchburg a, 24.5; Gilbertville, 22; Newburyport, 21.5; Fitchburg b, 21.2; Amherst a and Westborough, 19; Amherst b and Deerfield, 18.5; Provincetown, 17.7; Dudley, 16.2; Rowe, 15; Boston, 13.1; Milton, 12.5; Somerset, 11.2; Fall River, 11; Middleborough and Plymouth, 10.5; New Bedford, 10. *Michigan:* Bear Lake, 67.4; Benzonia, 58; Central Mine, 48; Saint Ignace and Snowflake, 46; Hillman, 44; Buchanan, 38; Traverse City, 37.5; Fletcher and Maple Hill, 34; Grand Rapids, 25.2; Hart, 25; Alpena, 23.9; Cassopolis, 23; Mio and Petersburg, 21; Mackinaw City, 20.7; May, 20.8; Kalamazoo, 20.5; Mottville and Paw Paw, 20; Marquette, 19.8; Pontiac, 19; Grand Haven, 17.9; Grayling, Greenville, and Harrisville, 17.8; Big Rapids, 17.2; Detroit, 16.6; Lansing (signal office) and Escanaba, 16; Jonesville, 15.7; Alma and West Branch, 15.5; Colon, 15.2; Saginaw, 14.8; Corunna, 14.6; Marshall, 14; Lansing (state Capitol), Adrian, and Coldwater, 13.5; Olivet and Williamstown, 13; Madison, 12.7; Pulaski, 12.4; Hastings, 11.8; Hanover and Ovid, 11; Saint John's, 10. *Minnesota:* Alexandria, 43.8; Ortonville and Excelsior, 39; Tracy, 32; Redwood Falls, 31.6; Fort Ripley, 28; Delano, 25.5; Mankato, 15; Minneapolis, 12.6; Rolling Green, 11; Red Wing, 10. *Missouri:* Springfield, 6.5. *Montana:* Fort Maginnis, 27.8; Helena, 12.4. *Nebraska:* Fremont, 10. *Nevada:* Fenelon, 33; Carlin, 22; Hawthorne, 20; Battle Mountain, 19; Wells, 17.5; Winnemucca, 13.4; Tecomia, 11.8; Beowawe, 11. *New Hampshire:* Plymouth, 36.5; Hanover, 34; Manchester a, 33.2; Manchester b, 32.5; Manchester a, 30.8; Antrim, 28; Nashua, 22.8. *New Jersey:* South Orange, 17; Beverly, 11. *New Mexico:* Gallinas Spring, 3.2. *New York:* Utica, 46; Oswego, 44; Palermo, 34.5; Saratoga Springs and North Volney, 26; Auburn, 22; Rochester and Ardenia, 21; Albany, 20.9; White Plains, 20; Menands, 19.2; Humphrey and Buffalo, 19; Le Roy, 18.3; Boyd's Corners, 15; New York City and Brooklyn, 13; Worcester, 12.5; Cooperstown, 11.5; Penn Yan, 10.6. *North Carolina:* Chapel Hill, 3. *Ohio:* Jefferson, 18.7; Garrettsville, 15.5; Ruggles, 14; Sidney, 13.5; Wauseon, 13.3; Cleveland a, 12.8; Clarion, 12.5; Bangorville, 12.2; Upper Sandusky, 12; Cleveland b, 11.9; Hanging Rock, 11.6; Napoleon, 11.1; North Lewisburg and Oberlin,

10.5. *Oregon*: Linkville, 24.4; East Portland, 16; Lakeview, 15.8; Roseburg, 15; Portland, 12; Eola, 11.3. *Pennsylvania*: Eagles Mere, 41.3; Allegheny College, 30.5; Somerset, 25.8; Grampian Hills, 20; Blooming Grove, 19; Dyberry, 18.2; State College, 17.2; Wellsborough, 16.9; Easton, 16.8; Hollidaysburg, 16.5; Meadville and Lancaster, 15; Scranton, 14.8; Quakertown, 14.4; Phillipsburg, 14; Reading, 13.5; Indiana, 13.4; Wysox, Chambersburg, and Erie, 13; New Bloomfield, 12.8; Lebanon, 11.9; Huntingdon, 11.7; Greenville, 11.4; Catawissa, 10.8; Germantown, McConnellsburg, and Carlisle, 10.5; Driftwood, 10. *Rhode Island*: Providence, 12. *Tennessee*: Nashville, 9.1. *Texas*: Mesquite, 4. *Utah*: Promontory, 27; Corinne, 25; Ogden, 21; Blue Creek, 18; Salt Lake City, 16; Kelton, 15. *Vermont*: Northfield, 53.6; Newport, 45; Strafford, 40; Lunenburg, 30; Chelsea, 28.5; Burlington, 20; Manchester, 19.5. *Virginia*: Rappahannock, 13.8. *Washington Territory*: Spokane Falls, 24.6; Vashon, 23; Blakely, 14.8; Walla Walla, 10.7; Olympia, 10.5. *West Virginia*: Middlebrook, 23; Helvetia, 22.4; Buckhannon, 21. *Wisconsin*: Embarras, 26.9; Fredonia, 20; Manitowoc, 19.2; Deuster, 16.2; Fond du Lac, 16; Green Bay, 15.7; Franklin, 15; Lancaster, 13.5; Milwaukee and Prairie du Chien, 10. *Wyoming*: Camp Sheridan, 39.3.

DEPTH OF UNMELTED SNOW ON GROUND AT END OF MONTH.

[Expressed in inches and tenths.]

Reports show that there was but little snow remaining on the ground at the end of January to the south of the fortieth parallel. To the northward of the parallel mentioned the depth of unmelted snow was generally more than 2; in Dakota, Minnesota, Wisconsin, Michigan, in portions of Pennsylvania, New York, and throughout New England, except along the southern coast, the depth generally ranged from 15 to 50. The greatest depth, 54, was reported from both Central Mine, Mich., and Northfield, Vt. The depth at end of month, as reported from the various states and territories, is as follows:

Arizona: Prescott, trace. *California*: Nicolaus, 1.5. *Colorado*: Grand Junction, 1.5; Pike's Peak, 0.3. *Connecticut*: Middletown, 21.5; New Hartford, 17; Southington, 16; Hartford and Waterbury, 15; New Haven, 6; Voluntown, 4; Thompson Hill, 3; New London, 1. *Dakota*: Richardson, 24; Parkston, 18; Huron, 15; Webster, 12; Fort Totten, 10; Bismarck, 9; Yankton, 4; Fort Sully, 0.5; Rapid City, trace. *District of Columbia*: Kendall Green, 2.5; Washington City, 1. *Illinois*: Oswego, 10; Sandwich, 9; Sycamore, 3; Chicago, 2; Charleston, 0.1. *Indiana*: Logansport, 4.2; Butlerville and Sunman, trace. *Iowa*: Cresco, 26; Bancroft and Ames, 24; Independence, 18 to 24; Monticello, 18; Dysart, 16; Maquoketa and Muscatine, 15; Clear Lake and West Bend, 10; Sac City, 9; Cedar Rapids, 8; Dubuque, 6.5; Oskaloosa, 5 to 8; Clinton, 5; Manson, 4.3; Davenport, 3.8; Albia, 3; Des Moines and Fort Madison, 2; Osceola, drifts. *Kansas*: East Norway, drifts; Wakefield, trace. *Maine*: Lewiston, 45; Cornish, 42; Bar Harbor and Orono, 30; Portland, 26; Gardiner, 25; Skowhegan, 24; Eastport, 10. *Maryland*: Cumberland, 6; Woodstock, 4; Baltimore, 2. *Massachusetts*: Rowe, 32; Deerfield, 20; Amherst, 18; Fitchburg, 15; Westborough, 13; Lowell, 11; Gilbertville and Newburyport, 10; Dudley, 5; Boston and Milton, 3; Plymouth, 2 to 3; New Bedford, Provincetown, and Somerset, 2; Taunton, 1. *Michigan*: Central Mine, 54; Traverse City, 37; Mio and West Bend, 36; Escanaba, 30; Sault Saint Marie, 28; Snowflake, 27; Hart, 25; Benzonia, 24; Bear Lake and Big Rapids, 22; Mackinaw City and Fletcher, 20; Paw Paw, 19; Kalamazoo and Buchanan, 18; Greenville, 17.8; Hillman, 17; Benton Harbor, 15; Grand Haven, 14.8; Alpena, Alma, and May, 14; Cassopolis, Ovid, Lansing (state Capitol), and Saint John's, 12; Grand Rapids and Saint Louis, 11; Bad Axe, Concord, and Williamston, 10; Adrian and Jonesville, 9; Madison, Mount Morris, Hastings, Olivet, Pulaski, and Hudson, 8; Eden and Birmingham, 7; Mottville, Thornville, Highland Station, Coldwater, Hanover, Lansing (signal office), Port Huron, and Detroit, 6; Petersburg, 3. *Minnesota*: Morris, 30; Excelsior, 29; Glenwood, 28; Red Wing, 27;

Delano, 26; Duluth, 20; Saint Paul, 17; Mankato, 15; Moorhead, 10; Saint Vincent, 7; North Loup, trace. *Missouri*: Frankford, 2. *Montana*: Poplar River, 6; Fort Custer, 1. *Nebraska*: De Soto, 2; Hay Springs, Falls City, and Weeping Water, drifts; Crete, trace. *New Hampshire*: Hanover, 40; Manchester a, 30; Manchester b, 24; Nashua and Plymouth, 15. *New Jersey*: South Orange, 6; Beverly, 3; Moorestown, 2.5; Atlantic City, 2; Clayton, 1; Egg Harbor City and Vineland, 0.8. *New York*: Syracuse, 36; Palermo, 31; Auburn, 27; Utica, 23; Albany and North Volney, 20; Oswego, 18; Le Roy, 16; Humphrey, 14; Menands, 13; Penn Yan, 12; Facultyville, 9; Cooperstown and Rochester, 8; Buffalo, Friendship, White Plains, and Ithaca, 6; Boyd's Corners, 5; Brooklyn, 3; Setauket, 2; Ardenia and New York City, 1. *Ohio*: Hiram, 6; Garrettsville, 5; Wauseon, 4; Cleveland a, Lordstown, Napoleon, and Ruggles, 3; Toledo, 2.2; Cleveland b, Sandusky, and Tiffin, 2; Greenville, 1. *Pennsylvania*: Dryberry, 25; Blooming Grove, 20; Wellsborongh 14.2; Driftwood and Grampian Hills, 14; Corry, 12; Germantown, 10.5; Quakertown, 8; Reading, 7; Catawissa, 6; Erie and Westtown, 4; Phillipsburg, 3; Philadelphia, 2; Pittsburg, 1. *Rhode Island*: Providence, 1 to 2. *Utah*: Fort du Chesne, 3. *Vermont*: Northfield, 54; Chelsea, 38; Newport, Lunenburg, and Strafford, 36; Burlington and Manchester 30. *Virginia*: Rappahannock, 3; Petersburg, 0.5; Dale Enterprise, University of Virginia, and Wytheville, trace. *West Virginia*: Middlebrook, 6. *Wisconsin*: Fredonia, 40; Manitowoc, 36; Green Bay, 35; Deuster, 26; Lancaster, 24; Fond du Lac, 19; La Crosse, 18; Madison, 17; Prairie du Chien, 14; Milwaukee, 11. *Wyoming*: Camp Sheridan, 3.5; Fort Washakie, 1.

SLEET.

During the month sleet was of common occurrence in the Northern and Western States, being more frequent in the first half than in the second half of the month. In the Gulf States sleet fell on the 8th, 9th, 12th, 14th to 16th, 19th.

Excessive precipitation for the month of January, 1888.

States and stations.	Monthly, 6 inches, or more.	Specially heavy.			
		Am't.	Duration.	Date.	At rate of 1 inch, or more, per hour.
					Am't.
<i>Alabama.</i>					
Selma	11.50				
Gadsden	9.53				
Valley Head		3.00		16	
<i>British Columbia.</i>					
New Westminster	7.11				
<i>California.</i>					
Upper Mattole *	41.63	4.50			3
Do.		31.68		27 to 31	
Emigrant Gap	17.00				
Hydesville	14.81	8.86		28 to 31	
Colfax	13.28				
Eureka	12.95	3.91	24 00		30
Fort Gaston	12.58	3.10			3
Do.		4.00		27, 28, 29	
Georgetown	12.50				
Delta	10.40				
Santa Barbara	10.11				
Cisco	9.75				
Summit	9.20				
Santa Cruz	8.00				
Calistoga	7.87				
Oroville	7.72	2.16			2
Presidio/San Francisco	7.18				
Auburn	7.07				
Santa Monica	6.98				
San Francisco	6.81				
Alcatraz Island	6.76	2.10			3
Newhall	6.74				
E. Pasadena	6.55	4.95		3 to 5	
Oakland	6.43				
Anaheim	6.29				
Trapico	6.25				
Spadra	6.23				
Mason	6.11	2.38			1, 2
Templeton	6.05				
Los Angeles	6.04	3.39	19 15		3, 4
Benicia Barracks		3.16			2, 3
Riverside		2.31	10 30		3
Lewis Creek		2.45			4
<i>Connecticut.</i>					
Hartford	7.68	4.44	18 00		1
Voluntown	6.75	2.90		1, 2	
Southington		2.20	†	1, 2	

Excessive precipitation, etc.—Continued.

States and stations.	Monthly, 6 inches, or more.	Specially heavy.					
		2 inches, or more, per day.		At rate of 1 inch, or more, per hour.		Am't.	Duration.
		Am't.	Duration.	Am't.	Duration.		
Florida.							
Pensacola	2.18	h. m. 13 00	I				
Georgia.							
Forsyth	2.85	6 00	I				
Milledgeville	3.10	8 30	I				
Andersonsville	3.10	‡	I				
Illinois.							
Ottawa	6.00	3 00		13			
Indiana.							
Huntingburg	2.00			15			
Huntington	2.20			7			
Crawfordsville	2.00			12			
Lafayette	2.71			6, 7			
Farmland	2.22			6			
Fort Wayne	2.07			12			
Muncie	2.10			5			
Delphi	2.75			7			
Iowa.							
West Bend	2.00	6 30		12, 13			
Kentucky.							
Williamsburg	6.31						
Bowling Green	6.15						
Louisiana.							
Monroe	2.38			13			
Maine.							
Portland	6.05						
Massachusetts.							
Deerfield	6.24						
Mississippi.							
Hermanville	7.25						
Starkeville	6.48						
Greenville	6.11						
Nevada.							
Fort McDermitt	10.45	7 18		19, 20, 21			
New Hampshire.							
Antrim	2.00	13 00		25, 26			
New Jersey.							
South Orange	6.35	3 00		I			
Hanover	2.43			I			
Lambertville	2.15			I			
Locktown	2.70			I			
New Brunswick	2.60			I			
Paterson	3.46			I			
Tenafly	2.08			I			
Union	2.04			I			
New York.							
Boyd's Corners	2.64	16 00		I			
White Plains	2.80			I			
West Point	2.00			I			
Ardenia	2.00	§		I, 2			
North Carolina.							
Statesville	2.42	12 00		I			
Murphy	2.19			I			
Davidson	2.16			10			
Weldon	2.31			18			
Ohio.							
North Lewisburg	6.15						
Quaker City	2.06			5, 6			
Oregon.							
Eola	16.68	4.51		27, 28			
Astoria	13.84	2.74	24 00	29			
Yaquina Light-house	13.66	7.21		28, 29, 30			
Bandon	11.26	6.37		28, 29, 30			
Albany	10.77	4.05		28, 29			
East Portland	10.00						
Portland	8.50						
Roseburg	6.66						
Pennsylvania.							
Germantown	6.65	2.51		I, 2			
Easton	6.45	3.08		I			
Reading	2.30			I			
Wellsborough	2.60			I			
West Chester	2.22			I			
South Carolina.							
Abbeville	2.30			I			
Florence	2.35			2			
Tennessee.							
Chattanooga	6.79						
Knoxville	6.61						
Nashville	6.29						
Lawrenceburg	6.28						
Pittsburg	6.17						
Milan	6.03						
Fostoria	2.00			16			
Virginia.							
Rappahannock	6.03	3.22		19			
Do.		2.71		24			
Washington Territory.							
Neah Bay	14.58	3.96		25, 26			
Do.		4.08		27, 28, 29			
Tatoosh Island	12.10	2.65		25			
Do.		2.38		29, 30			
Pysht	11.75	2.05		25			
Do.		2.04		29			
Fort Canby	11.39						
Olympia	11.38						
Vashon	9.74	2.25		23, 24			
Tacoma	9.06	3.00		24, 25, 26			
Blakely	7.59	2.80		25			

Table showing for the month of January monthly rainfalls of 10 inches, or more; rainfalls of 2.50 inches, or more, in any 24 consecutive hours; and rainfalls equaling or exceeding one inch in one hour.

States and stations.	Rainfall of 10 inches, or more, per month.	Rainfall of 2.50 inches, or more, in 24 hours.		Rainfall equaling or exceeding one inch per hour.			
		Year.	Day.		Year.	Day.	Time.
Alabama.	Inches	Inches	Inches				
Mobile	1885	11.95	1871	26	2.50		
Do.			1885	23	3.78		
Montgomery			1885	23-24	3.13		
Arizona.							
Prescott			1885	24-25	2.56		
Do.			1886	18	3.90		
California.							
El Monte	1875	10.20	1886	18-19	3.77	1886	18
Los Angeles						1 00	1.25
Do.						1 00	1.15
Red Bluff	1878	20.71					
Sacramento			1881	29	2.66		
Do.			1886	23	2.58		
San Diego			1882	12-13	2.70		
San Francisco			1881	28-29	4.00		
Do.			1881	29	4.67		
Santa Cruz	1875	16.87	1881	29-30	3.27		
Do.	1876	10.86					
Connecticut.							
New Haven			1881	9-10	2.74		
Florida.							
Cedar Keys			1881	7-8	3.60		
Jacksonville			1877	11-12	3.46		
Do.			1881	8	3.09		
Key West			1879	9-10	2.97		
Do.			1879	23-24	3.97		
Pensacola			1881	4	3.52		
Do.			1883	17	3.08		
Georgia.							
Atlanta	1883	15.82	1881	19-20	3.03		
Do.			1886	3	2.62		
Augusta			1872	27-28	2.52		
Do.			1881	19-20	2.52		
Savannah			1875	6-7	2.88		
Do.			1883	17-18	3.45		
Cairo	1876	15.05	1873	15-16	2.53	1876	17
Do.			1876	17-18	5.17		
Indiana.			1876	27-28	2.70		
Indianapolis							
Indian Territory.							
Fort Sill			1885	17	2.67		
Dubuque			1876	1	2.58		
Louisville	1876	11.63	1876	18	3.36		
Louisiana.							
New Orleans			1881	11.51	1881	3	2.82
Do.			1883	10.63	1883	18-19	3.70
Do.			1885	4-5	2.62		
Shreveport	1885	12.11	1872	5	3.19		
Do.			1885	13	5.71		
Do.			1885	14	4.27		
Massachusetts.							
Boston			1875	10-11	2.58		
Do.			1881	21-22	3.15		
Florida.	1874	17.25	1874	21	3.00		
Michigan.							
Grand Haven			1887	22	2.69		
Northport			1874	21-22	3.20		
Mississippi.							
Vicksburg			1875	23-24	3.76		
Do.			1885	15-16	3.66		
New York.							
Adams			1874	6-7	3.06		
New York City			1874	7-8	2.82		
Do.			1881	9-10	2.59		
Oneida	1874	13.03					
Parson's Creek Reservoir			1874	7	3.07		
North Carolina.							
Hatteras	1883	13.99	1879	12	3.26		
Do.			1883	19	4.01		
Do.			1884	8	2.79		
Kitty Hawk	1878	10.15					
Portsmouth	1883	11.43					
Scott's Hill	1883	14.18					
Wilmington			1874	5	4.56		
Do.			1876	9	3.19		
Do.			1880	26	2.53		
Ohio.							
Cincinnati			1876	17-18	2.97		
Oregon.							
Astoria	1874	17.66	1887	25-29	2.70		
Do.							

Table showing for the month of January, &c.—Continued.

States and stations.	Rainfall of 10 inches, or more, per month.		Rainfall of 2-50 inches, or more, in 24 hours.		Rainfall equaling or exceeding one inch per hour.	
	Year.	Amt.	Year.	Day.	Year.	Day.
Tennessee.						
Chattanooga.	1882	Inches, 14-74	1879	8-9	Inches	
Do.			1879	11-12	3-77	
Do.			1882	15-16	3-32	
Do.			1886	2-3	3-92	
Do.			1887	23-24	3-54	
Knoxville.	1882	16-98	1875	26-29	2-82	
Do.			1879	8-9	3-60	
Do.			1879	11-12	3-30	
Do.			1882	16-17	2-51	
Do.			1882	20-21	2-74	
Do.			1882	28	2-94	
Memphis.	1882	12-87	1872	15-16	3-50	
Do.			1875	1-2	2-58	
Do.			1875	27-28	3-95	
Do.			1880	5	2-92	
Do.			1882	16-17	3-65	
Nashville.	1882	14-51	1887	22-23	3-08	
Texas.			1882	12-13	2-77	
Clarksville.	1875	13-25	1874	23	2-50	
Do.			1874	31	4-08	
Do.			1875	.....	6-50	
Galveston.			1877	21	3-61	1879
Do.			1883	5-6	3-48	31
Do.			1885	15-16	3-04	1-05
						1-47

Table showing for the month of January, &c.—Continued.

States and stations.	Rainfall of 10 inches, or more, per month.		Rainfall of 2-50 inches, or more, in 24 hours.		Rainfall equaling or exceeding one inch per hour.	
	Year.	Amt.	Year.	Day.	Year.	Amt.
Utah.						
Coalville.					1875	14-15
Mount Carmel.					1874	2-70
Do.					1874	3-4-00
Do.					1874	15-4-00
Virginia.					1874	20-3-00
Lynchburg.					1885	23-6-32
Washington.						
Canby, Fort.					1887	11-91
Catalanet.					1874	14-53
Neah Bay.					1874	30-50
Do.					1879	13-93
Do.					1884	15-50
Do.					1885	17-70
Do.					1886	16-40
Do.					1887	22-30
Olympia.					1880	19-69
Fysht.					1884	11-29
Do.					1885	14-31
Do.					1886	11-44
Do.					1887	13-76
Tatoosh Island.					1884	13-32
Do.					1885	14-47
Do.					1886	16-82
Do.					1887	14-46
Do.					1888	29-30

WINDS.

The most frequent directions of the wind during January, 1888, are shown on chart ii, by arrows flying with the wind. In the upper Mississippi, Missouri, Ohio, and Saint Lawrence valleys, Lake region, and in the states bordering on the Atlantic, the most frequent directions were generally westerly or northwesterly; along the Gulf coast, northerly; on the Pacific coast and in the Rocky Mountain regions, variable.

HIGH WINDS (in miles per hour).

The maximum velocities of wind for January, 1888, at Signal Service stations where the movements are registered,

are given in the table of miscellaneous meteorological data. Other than the maximum velocities given in the table referred to, the following velocities of fifty, or more, miles per hour have been reported: Pike's Peak, Colo.,* 84, nw., 1st; 84, w., 2d; 80, w., 3d. Buffalo, N. Y., 50, w., 10-11th. Fort Totten, Dak., 50, s., 11th. Huron, Dak., 50, nw., 13th. Fort Canby, Wash., 52, s., 22d; 54, s., 26th; 68, s., 28th; 54, s., 29th. Tatoosh Island, Wash., 54, s., 25th; 53, se., 27th; 51, s., 28th. Wood's Holl, Mass., 50, w., 26th.

* At Pike's Peak, only, velocities exceeding seventy-five miles are given.

INLAND NAVIGATION.

ICE IN RIVERS AND HARBORS.

Frenchman's Bay.—Bar Harbor, Me.: there was much ice in the bay during latter part of month; navigation closed 28th.

Casco Bay.—Portland, Me.: the harbor was frozen over with thin ice from the 24th to the 28th, making navigation difficult. During the storm of the 26th the bay was completely filled with ice, rendering navigation impossible.

Boston Harbor.—Boston, Mass.: the harbor was almost entirely frozen over on the 23d.

Holmes Hole Harbor.—Vineyard Haven, Mass.: the harbor was frozen over from the 17th to the 23d.

Nantucket Harbor.—Nantucket, Mass.: the harbor froze over on the 21st, closing navigation.

Wood's Holl Harbor.—Wood's Holl, Mass.: the harbor was blockaded with ice and frozen solid to Nantucket Island on 21st. Buzzard Bay was also frozen for several hundred yards from the shore; all navigation was temporarily suspended on the above date.

Edgartown Harbor.—Edgartown, Mass.: the harbor froze over on the 24th and remained frozen to the end of month.

New Haven Bay.—New Haven, Conn.: the harbor froze over on the 17th.

Lake Champlain.—Burlington, Vt.: the lake froze over on the 22d, seven days earlier than the average date for the last seventy years.

East and North rivers.—New York City: floating ice in both

rivers on the 3d; East River was choked with ice on the 19th, 28-29th. There was an unusual amount of drift ice in the upper bay on the 23d.

Seneca Lake.—Starkey, Yates Co., N. Y.: on the morning of the 22d the lake was frozen over. It rarely occurs that this lake freezes over before February.

North Branch Susquehanna River.—Catawissa, Columbia Co., Pa.: river opened on the 2d and closed again on 20th.

Chesapeake Bay and Baltimore Harbor.—Baltimore, Md.: ice in bay and harbor rendered navigation difficult on 23d, 24th, and 25th; winds cleared the harbor of ice on the 26th.

Kitty Hawk Bay.—Kitty Hawk, N. C.: navigation closed 30th.

Alleghany and Monongahela rivers.—Pittsburg, Pa.: floating ice in both rivers on 1st, 3d to 8th, 22d to 24th, 27th to 29th, and in Alleghany River from 9th to 21st, 23d, 25th, 26th; on the 2d ice carried away a span of the 30th street bridge.

Ohio River.—Portsmouth, Scioto Co., Ohio, 31st: there was more or less floating ice in river during the entire month, and much of the time it was so heavy as to prevent navigation.

Louisville., Ky.: floating ice on 3d rendered navigation dangerous; navigation suspended from 21st to 25th, and 27th, 28th.

Cairo, Ill.: floating ice from 17th to 21st.

Mississippi River.—The Mississippi was frozen throughout the month at Keokuk, Iowa, and to the northward.

Saint Louis, Mo.: a rapid rise in river occurred on the 23d, caused by an ice dam at Carondelet, a few miles south.

Cairo, Ill.: floating ice on 1st, 2d, 8th, and 14th. An ice dam formed at Bird's Point, Mo., on the 15th and remained intact until the 31st, when it broke.

Missouri River.—The Missouri was frozen throughout the month at Leavenworth, Kans., and to the northward.

Arkansas River.—Little Rock, Ark.: floating ice 17th, 21st.

Mackinaw Strait.—Mackinaw City, Mich.: the strait froze over on the 1st, on the 2d the ice was about two inches thick.

Saint Clair River.—Port Huron, Mich.: floating ice on 2d, 4th, 6th, 8th, 10th, 11th, 19th. Navigation closed on the 12th. An ice bridge formed on the 20th.

Sacramento River.—Sacramento, Cal.: floating ice on the 14th, the first observed since 1854.

Columbia River.—Portland, Oregon: river froze over on 9th, closing navigation; river was still frozen on 26th.

Willamette River.—Portland, Oregon: river froze over on 13th; people crossed on ice on 15th; ice broke up on 25th; navigation resumed on 26th.

FLOODS.

Los Angeles, Cal: the heavy rains of the 3d and 4th caused numerous washouts on the railroads in this section, causing suspension of travel.

Boisé City, Idaho: an ice-dam formed in Cottonwood Creek on the 24th, causing an overflow in the eastern part of the city. Some of the farmers in the valley near here lost considerable hay and grain by the freshet on the 25th. On the 26th the Idaho Central Railroad was submerged at Ten-Mile Creek, between Boisé City and Nampa, and no trains passed over the road on that date.

Fort Assinaboine, Mont., 30th: during the recent warm weather the rivers in this section have overflowed and some railroad bridges have been carried away by the flood. No mail has arrived for four days.

Eureka, Humboldt Co., Cal., 31st: owing to the recent very heavy rains the streams in this section have risen to unusual heights, and in some localities considerable areas have been flooded; bridges were swept away, and numerous washouts occurred.

Hydesville, Humboldt Co. Cal.: the heavy rains of the 29th to the 21st caused the rivers in this county to reach the highest stages known during the last nine years.

STAGE OF WATER IN RIVERS AND HARBORS.

The Ohio at Pittsburg rose continuously from the 1st to 8th, and, having risen about eighteen feet, was within seventeenths of a foot of the danger line on the last-named date. This rise permitted large fleets of coal barges to move down the river.

Nashville, Tenn., 2d: the heavy rains of December 31st and January 1st caused the Cumberland River to rise 14.5 feet in twenty-four hours, giving a depth sufficient for navigation on both the upper and lower Cumberland. Navigation has been closed on account of low water since June 19, 1887.

Louisville, Ky.: the river was very low on the 1st, but by the 9th it had risen sufficiently to permit the running of the larger steamers. The river reached its highest stage on the 15th, when it was about ten feet higher than on the 1st.

In the following table are shown the danger-points at the various stations, the highest and lowest depths for January, 1888, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, January, 1888 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La.	29.9	24, 25	20.4	*	8, 9	17.3 3.1
<i>Arkansas River:</i>						
Fort Smith, Ark.	22.0	31	6.5	2	1.3	5.2
Little Rock, Ark.	23.0	15	5.8	6, 7	2.6	3.2
<i>Missouri River:</i>						
Omaha, Nebr.	18.0	.....	.....	.....	.....	.....
Leavenworth, Kans.	20.0	.....	.....	.....	.....	.....
<i>Mississippi River:</i>						
Saint Paul, Minn.	14.5	.....	.....	.....	.....	.....
La Crosse, Wis.	24.0	.....	.....	.....	.....	.....
Dubuque, Iowa	16.0	.....	.....	.....	.....	.....
Keokuk, Iowa	14.0	.....	.....	.....	.....	.....
Saint Louis, Mo.	32.0	31	15.5	1	3.5	11.8
Cairo, Ill.	40.0	20	27.9	1	1.80	26.1
Memphis, Tenn.	34.0	22	22.0	3, 4	1.8	20.2
Vicksburg, Miss.	41.0	26, 27	26.3	7, 8	1.3	17.6
New Orleans, La.	13.0	31	8.6	3, 10, 11	1.7	6.9
<i>Ohio River:</i>						
Pittsburg, Pa.	22.0	8	21.3	31	2.3	19.0
Cincinnati, Ohio	50.0	13, 14	34.4	5	8.8	25.6
Louisville, Ky.	25.0	15	13.1	1	3.2	9.9
<i>Cumberland River:</i>						
Nashville, Tenn.	40.0	22	23.0	1	3.4	19.6
<i>Tennessee River:</i>						
Knoxville, Tenn.	.....	18	12.6	30, 31	2.9	9.7
Chattanooga, Tenn.	33.0	19	25.7	31	5.6	20.1
<i>Monongahela River:</i>						
Pittsburg, Pa.	29.0	8	21.3	31	2.3	19.0
<i>Savannah River:</i>						
Augusta, Ga.	32.0	2	25.0	31	8.3	16.7
<i>Sacramento River:</i>						
Red Bluff, Cal.	.....	31	17.6	15-19	0.8	16.8
Sacramento, Cal.	.....	24	17.6	20	5.5	9.1
<i>Willamette River:</i>						
Portland, Oregon	.....	31	16.5	9	0.0	16.5

* River frozen entire month. † Below bench-mark.

LOW TIDE.

Baltimore, Md., 28th.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Moorhead, Minn.: an auroral arch was observed during the night of the 7-8th, being very brilliant at 6.30 a. m., at which time the arch had risen to an altitude of 22°; numerous streamers shot up to an altitude of 75°. The display began at 8 p. m. and ended at daylight.

Lyons, N. Y.: a fine aurora, with streamers, was observed from 8 to 10 p. m. on the 13th. During the morning of the 17th a diffuse aurora, with streamers at intervals, was visible from 3 to 4 a. m.

Saint Vincent, Minn.: an auroral arch was visible from 8 p. m. on the 7th until sunrise on the following day; before midnight the display consisted of a low, broad arch, with an altitude of 10°, and covered 100° of the horizon. At 7 a. m. the display was probably at its maximum, at which time huge flames of light rolled up to within 10° of the zenith.

Northfield, Vt.: a brilliant aurora was observed from 8.30 to 10.30 p. m. on the 13th. It consisted of streamers which seemed to radiate from the horizon; the central streamer was

located in the magnetic north and during the period of greatest brilliancy, from 9 to 9.15 p. m., it reached an altitude of 50°. The display covered about 50° of the horizon, and the color was like that of an electric light.

Auroras were also observed during the month as follows: 6th, Poplar River, Mont. 7th, Garden City, Webster, and Huron, Dak.; Northfield, Vt.; Saint Vincent, Minn.; Poplar River, Mont., and Nashua, N. H. 8th, Fort Totten and Bismarck, Dak.; Cornish and Orono, Me.; Saint Vincent and Duluth, Minn.; Fort Assinaboine, Mont.; Embarras, Green Bay, and La Crosse, Wis. 9th, Palermo, N. Y. 10th, Lansing, Mich., and Saint Vincent, Minn. 12th, Egg Harbor City, N. J.; Palermo, N. Y.; Eastport, Me. 13th, Mackinaw City and Marquette, Mich.; Saint Vincent, Minn.; Poplar River, Mont.; Friendship and Setauket, N. Y.; Spokane Falls, Wash. 14th, Fort Totten, Dak.; Saint Vincent, Minn.; Fort Assinaboine and Poplar River, Mont. 15th, Saint Vincent, Minn.; Embarras, Wis. 16th, Marquette, Mich.; Fort Assinaboine, Mont.; Egg Harbor City, N. J.; Lunenburg, Vt. 17th, Nashua, N. H.; Poplar River, Mont. 23d, Nashua, N. H.

24th, Saint Vincent, Minn.; Ardenia, N. Y. 25th, Gardiner, Me. 27th, Pekin, Ill. 28th, Palermo, N. Y.

THUNDER-STORMS.

Thunder-storms occurred as follows: Mobile, Ala., 1st; Alcatraz Island, Angel Island, Oakland, Presidio of San Francisco, and San Francisco, Cal., 4th; Red Bluff, Cal., 23d; Titusville, Fla., 1st; Limona, Fla., 18th; Savannah and Quitman, Ga., 1st; Globe and Salina, Kans., 5th; Manhattan, Kans., 6th; Liberty Hill, La., 15th; Conception, Mo., 4th; Pierce City, Mo., 6th; Charleston and Stateburg, S. C., 1st; San Antonio, Tex., 12th; Cedar Hills, 14th; Palestine, Tex., 18th.

ELECTRICAL PHENOMENON.

Fort Assinaboine, Mont.: there was a constant display of light on the wires during the storm of the 11th, and the wires in the telegraph office became almost unmanageable.

Huron, Dak.: during the storm of the 12th metals and other substances emitted electrical sparks. Severe shocks were felt by persons shaking hands.

Fort Maginnis, Mont.: during the storm of the 12th the atmosphere was very highly charged with electricity from 3 p. m. until midnight, interfering considerably with the working of the telegraph lines; upon touching any metallic surface shocks were felt.

MISCELLANEOUS PHENOMENA.

METEORS.

Orono, Me.: a meteor, apparently about one-fourth the size of the moon, was observed at 6.40 p. m. on the 4th; it started near the zenith and moved in direction south 40° east, disappearing when within about 40° of the horizon. Although the sky in the region of its path was cloudy at the time it illuminated the horizon with a bright light.

Fort Sill, Ind. T.: an unusually bright meteor was observed at 8.45 p. m. on the 4th; it started from about 75° above the southwest horizon, moved a little to the southwest, and disappeared when at an altitude of about 30°; during the passage of the meteor the southwestern sky was illuminated as though the full moon shone; it was visible for ten seconds. This meteor was also seen at Fort Reno, Ind. T., and was probably the same seen at Abilene, Tex., and Yates Centre, Kans.

Meteors were also observed as follows:

1st, Wytheville, Va. 2d, Webster, Dak., and Yates Centre, Kans. 4th and 6th, Rappahannock, Va. 7th, Wytheville and Dale Enterprise, Va. 9th, Tribune, Kans. 10th, Lamar, Mo.; Woodstock, Md.; Dale Enterprise, Va.; Rappahannock, Va. 11th, Woodstock, Md.; Dale Enterprise, Va. 12th, Nashua, N. H.; Wytheville, Va.; Fort Stanton, N. Mex. 13th, Lead Hill, Ark., and Manhattan, Kans. 14th, Provincetown, Mass. 20th, Fall River, Mass. 23d, Dubuque, Iowa. 24th, Wytheville, Va. 27th, Washington City and Chicamico, N. C. 28th, Omaha, Nebr., and Woodstock, Md. 30th, Grand Junction, Colo. 31st, Variety Mills, Va.

MIGRATION OF BIRDS.

Geese flying southward.—Yates Centre, Kans., 1st, 3d; Chattanooga, Tenn., 3d; Kitty Hawk, N. C., 10th; Wilmington, N. C., 11th, 20th; Red Bluff, Cal., 23d.

Geese flying northward.—Red Bluff, Cal., 10th; Corsicana, Tex., 14th; Augusta, Ga., 21st, 27th; Globe, Kans., 29th.
Brants flying southward.—Kitty Hawk, N. C., 10th.

MIRAGE.

Corpus Christi, Tex.: at 3 p. m. on the 2d Mustang Island, twenty-two miles from this place, was plainly seen on the horizon, over Corpus Christi Bay; the phenomenon continued until 5 p. m. A similar display was observed from 11 a. m. to 4 p. m. on the 27th.

Fort Maginnis, Mont.: Mason Lake and its surroundings, situated about forty miles distant, were plainly seen from 9.45 to 10.45 a. m. on the 23d.

Webster, Day Co., Dak.: unusually fine displays of mirage were observed on the 29th and 31st; on the first-named date, Wohbay, and on the latter, Bristol, and their surroundings, were plainly seen.

Mirages were also observed as follows: Garden City, Dak., 29th; Cedar Keys, Fla., 21st; Tribune, Kans., 1st, 2d, 3d, 10th, 11th, 17th to 19th, 23d, 25th, 26th, 29th, 31st; Fort Maginnis, Mont., 23d; Poplar River, Mont., 14th, 17th, 20th, 21st, 28th, 29th; Marquette, Nebr., 2d, 10th, 18th, 26th, 29th to 31st; Corpus Christi, Tex., 28th.

PRAIRIE FIRES.

Fort Sill, Ind. T., 2d; Fort Reno, Ind. T., 4th.

SAND STORMS.

Willeox, Ariz., 3d, 4th, 10th; Fort Grant, Ariz., 4th, 10th, 18th.

SUN SPOTS.

Mr. H. D. Gowey, North Lewisburg, Champaign Co., Ohio, observed sun spots as follows: 1st, 2d, 10th, 13th, 14th, 18th, 21st.

VERIFICATIONS.

CAUTIONARY SIGNALS.

Of the total number of cautionary and storm signals ordered during January, 1888, it was practicable to determine the justification or failure of fifty-four; justified, thirty-seven, or 68.52 per cent. Of the above, twelve were ordered for cautionary signals; number justified, seven, or 58.33 per cent. Forty-two storm signals were ordered; justified, thirty, or 71.43 per cent. Total number of direction signals ordered, fifty-six; justified, fifty-four, or 96.43 per cent. Number of signals ordered for easterly winds, eleven; justified, ten, or 90.99 per cent. Number of signals ordered for westerly winds, forty-five; justified, forty-four, or 97.78 per cent. Number of storms without signals, none. Number of signals ordered late, i. e., after the justifying velocity had begun, twelve, or 22.22 per cent.

COLD-WAVE SIGNALS.

Total number of cold-wave signals ordered from Office Chief Signal Officer, two hundred and sixty-one; justified, one hun-

dred and eighty, or 68.97 per cent. Eighty-one cold-wave signals were ordered during the month by the Signal Service Officer at Saint Paul, Minn., of which, seventy-five, or 92.59 per cent., were justified.

INDICATIONS FOR 33 HOURS IN ADVANCE.

The percentages of verifications of the tri-daily indications for January, 1888, as determined from comparison of preceding telegraphic reports are given in the table below.

The predictions for all districts east of the Rocky Mountains for January, 1888, were made by Junior Professor H. A. Hazen, except those for Minnesota, eastern and central Dakota, which were made at Saint Paul, Minn., by 1st Lieutenant Thomas M. Woodruff, 5th Infantry, U. S. Army, Acting Signal Officer; those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps; the verifications for all districts were determined by Junior Professor C. F. Marvin:

Percentages of indications verified, January, 1888.

States.	States.
Maine.....	73.84
New Hampshire	74.19
Vermont.....	70.10
Massachusetts.....	69.97
Rhode Island	69.84
Connecticut	67.32
Eastern New York	69.52
Western New York	65.03
Eastern Pennsylvania	74.29
Western Pennsylvania	65.52
New Jersey.....	73.55
Delaware	73.32
Maryland	75.12
District of Columbia.....	74.00
Virginia	72.55
North Carolina	73.39
South Carolina	74.58
Georgia	71.03
Eastern Florida	77.00
Western Florida	71.03
Alabama	71.68
Mississippi	74.58
Louisiana	74.48
Texas.....	73.23
Arkansas	73.55
Tennessee	68.65
<i>By elements:</i>	
Weather	74.15
Wind	75.36
Temperature	69.03
General average.....	
	72.22

* In determining the general average percentage and the percentages for the different elements, Minnesota, eastern and central Dakota, and Pacific coast states have not been included.

LOCAL VERIFICATIONS.

The following is from the report of the "Michigan State Weather Service" for January, 1888:

Weather and temperature signals are now displayed in one hundred and forty-three towns in the state, and on the baggage-cars of twenty-six trains on eight principal railroads of the state.

The indications and cold-warnings are issued by the Chief Signal Officer and distributed to the different stations through the central office. The indications

are issued at 1 a. m., daily, from the Chief Signal Office, Washington, and are for the twenty-four hours from 7 a. m. to 7 a. m.

The percentage of verification of these indications for January is as follows (the verification is taken from reports of displaymen furnished this office monthly): temperature, 78.8 per cent.; weather, 83.5 per cent.; temperature and weather, 80.9 per cent.

The percentage of verification of weather predictions for January on the D. G. H., and M. R'y., is 80.0 for weather, and 74.3 for temperature; on the C. & G. T. R'y., weather, 80.7, and temperature, 76.0; P. H. & N. W. R'y., weather, 85.0, and temperature, 79.7; M. C. R'y., for weather, 86.2, and for temperature, 83.7; G. R. & I. R'y., weather, 81.3, and temperature, 81.3; C. & W. M. R'y., weather, 90.0, and temperature, 77.7; P. O. & P. A. R'y., weather, 80.0, and temperature, 79.0.

Cold-wave signals were ordered by the Chief Signal Officer on the 1st, and were verified on the 2d; on the 6th and continued until 7 a. m. of the 8th, and were justified by average fall of 26° in temperature; on the 13th and continued until 3 p. m. of the 14th; on the 15th at 7 a. m. and continued until 7 a. m. of the 16th; on the 19th at 6.30 p. m. and continued until 7 a. m. of the 21st; on the 25th at 6.15 p. m. and continued until 7 a. m. of the 28th. The temperature fell from 15° to 25° in the time specified by the warnings.

Many favorable comments were made on the benefits derived.

The following is from the January, 1888, report of the "South Carolina Weather Service":

The percentage of verification of the weather and temperature predictions for the whole state was: for weather, 71.5; for temperature, 74.7.

The following is from the "Tennessee State Board of Health Bulletin" for January, 1888:

There were six cold-wave predictions—that of the 4th being partly verified, failing in the western division, also that of the 18th being only partly verified, failing in some portions of the middle division, and those of the 6th and 18th being twenty-four to forty-eight hours later than the predictions indicated. The others were generally fully verified.

The percentage of verification of weather and temperature predictions, furnished daily from the Signal Office at Washington to the various stations in the state during the month was, for the state: weather, 64.8 per cent., and temperature, 67.2 per cent.

STATE WEATHER SERVICES.

The following extracts are republished from reports for January, 1888, of the directors of the various state weather services:

The "Alabama Weather Service," P. H. Mell, Jr., of the Agricultural and Mechanical College, Auburn, director:

The temperature was about normal.

Although there were rainy days during the month, still the precipitation was only 0.78 of an inch above the normal. The season was quite unpleasant on account of the constant dampness of the atmosphere.

In this section of the United States January is generally a disagreeable month, both on account of the degree of cold and also the frequency of rains, so that the past month has only been exceptionable because of the small number of really cold days it contained.

There were three cold waves predicted, viz., on the 7th, 14th, and 15th; that of the 15th was the only one verified.

Summary.

Atmospheric pressure (in inches).—Monthly mean, 30.30; maximum observed, 30.69, at Auburn, on the 19th; minimum observed, 29.79, at Montgomery, on the 1st; range for state, 0.90.

Temperature (in degrees Fahr.).—Monthly mean, 46.4; highest monthly mean, 51.1, at Montgomery; lowest monthly mean, 39°.3, at New Market; maximum, 78°, at Newton, on 6th; minimum, 10°, at Gadsden, on the 19th; range for state, 68°; greatest local monthly range, 62°, at Gadsden; least local monthly range, 48°, at Selma.

Precipitation, including melted snow (in inches).—Average for the state, 4.74; greatest, 11.50, at Selma; least, 0.54, at Bermuda.

Wind.—Prevailing direction, northwest.

The "Monthly Review of the Illinois Weather Service," Col. Charles F. Mills, Springfield, director:

The meteorological features of January presented some rather unusual characteristics, the principal of which were high barometer, low temperature, and some remarkably sudden changes.

The mean temperature of the month was 5°.8 below the normal of the past ten years; the difference being greatest in the northern and least in the southern division, 6°.4 in the former and 4°.4 in the latter. The 15th and 16th were the two coldest days. The most remarkable feature, however, was the great range of the 13th, when the thermometer fell from 50° to 55° in the northern and western parts of the state, and from 35° to 45° in the southern, in twenty-four hours. This was the greatest, as well as the most sudden, fall ever recorded in the state. On twenty-three days during the month the temperature was reported below zero, and the lowest point reached was 80° below.

The precipitation was 0.24 inch above the average of the past ten years, dis-

tributed as follows: 0.32 inch below in the northern division, 1.50 inches above in the central, and 0.33 inch below in the southern. Except in the northern portion of the state the greater portion of precipitation was in the form of rain and sleet; the snowfall was below the average. The greatest precipitation occurred on the 6th, 12th, and 14th.

The "Indiana Weather Service," Prof. H. A. Huston, of Purdue University, Lafayette, director:

The mean barometric pressure over Indiana during January, 1888, was 0.145 inch above normal; the highest pressure occurred on the 16th, when the barometer at many places rose to the unusual height of over 31 inches; the lowest, 29.71, occurred on the 1st. Barometric changes were very abrupt and frequent, especially so on the 1st, 4th, 6th, 13th, and 30th. On the 13th the barometer, in fifteen hours, fell from about 30.5 to 29.9 inches, and rose equally as fast to 30.5 again, and continued to rise steadily until it reached its greatest height on the 16th.

The month was uniformly cold. The mean temperature was slightly below the normal, and the daily mean temperature was only above the normal from the 4th to 7th and 29th to 31st; nevertheless the reading of the thermometers was not as low as during January, 1887, especially so in the central and southern parts of the state.

The precipitation during January was generally slightly above normal, the most frequent falls occurred during the first half of the month. On the 15th sleet fell at many places from 3 to 6 inches deep; being preceded by rain and followed by snow and a temperature below zero, a solid cover of ice formed which lasted for many days. The snowfall in the central and southern parts, was slight, but in the northern part it reached a depth of fifteen inches.

Summary.

Atmospheric pressure (in inches).—Monthly mean, 30.289; maximum observed, 31.071, at Lafayette, on the 16th; minimum, 29.710, at Worthington and Indianapolis, on the 1st; range for state, 1.361; greatest local range, 1.230, at Indianapolis; least local range, 0.999, at Mount Vernon.

Temperature (in degrees Fahr.).—Monthly mean, 28.2; highest monthly mean, 32.3, at Marengo; lowest monthly mean, 16.0, at La Grange; maximum, 67.0, at Degonia Springs, on the 6th; minimum, —16.0, at Logansport, on the 16th; range for state, 61.5; greatest local monthly range, 73.0, at Logansport; least local monthly range, 52.0, at Angola.

Precipitation, including melted snow (in inches).—Average for the state, 3.03; greatest, 5.83, at Huntington; least, 1.18, at Bloomington.

Wind.—Prevailing direction, northwest.

The "Kansas Weather Service," Prof. J. T. Lovewell, Topeka, director:

The temperature has been below the January average. The month opened with a warm wave; the temperature then declined until it culminated in the severe cold wave of the 14-15th; it remained low during the succeeding week and was followed by a cold wave on the 20th and 21st, after which it rose, the highest for the month occurring from the 28th to the 31st. The local ranges in temperature were unusually large; the mean monthly range for the middle division, 86°, and for the western division, 90°.

The precipitation is below the January normal, the average for the state being 0.56 of an inch; it was unevenly distributed, as follows: 60.8 per cent. fell in the eastern division, 35.2 per cent. in the middle division, while but 4.5 per cent. fell in the western division; again, in the eastern division the greater portion fell during the storm of the 5-7th, while in the middle and western divisions it fell on the 12th.

Summary.

Temperature (in degrees Fahr.).—Monthly mean, 19.4; highest monthly mean, 27, at Sedan; lowest monthly mean, 15, at Gibson and Cawker City; maximum, 73, at Collyer, on the 28th; minimum, —32, at Cawker City, on the 15th; range for state, 105; greatest local monthly range, 95°, at Eustis; least local monthly range, 72, at Lawrence; greatest daily range, 48, at Gibson, on the 10th; least daily range, 1, on the 14th, at Rome.

Precipitation, including melted snow (in inches).—Average for the state, 0.56; greatest, 1.40, at Grenola; least, 0.03, at Ellis.

Wind.—Prevailing direction, north.

The "Louisiana State Weather Service," in charge of R. E. Kerkam, Sergeant, Signal Corps, at New Orleans:

The mean temperature of the state for the month, 50°, was 1° above the January normal of the past seventeen years. The mean of the northern section was slightly below, and of the southern section was slightly above, their respective January normal temperatures. The mean daily range of temperature for the state was 16°.4; for the northern section, 16°.6, and for the southern section, 16°.3. The greatest daily range of temperature, 47°.8, was reported from Madison Parish on the 15th, and the least, 1°.8, from Caddo Parish on the 9th. The greatest mean daily range reported was 21°.9 from Concordia Parish, and the least was 11°.5 from Ouachita Parish.

The precipitation for the month was comparatively light and evenly distributed between the 5th and 25th. A heavy rainfall of 2.38 inches was reported from Monroe on the 13th, but was the exception; although moderately heavy daily rainfalls, ranging from 0.62 of an inch to 1.64 inches were reported from elsewhere in the state on the 8th, 9th, 12th, 13th, 24th, and 25th. The average precipitation for the state, 3.17 inches, was 2.43 inches below the January normal of the past eighteen years. The deficiency in the average precipitation ranged from 1.9 inches for the northern section to 2.8 inches for the southern section. An average of 1.3 inches (unmelted) of snow and sleet fell in the northern section on the 15-16th, being particularly heavy at Coushatta, from which place a fall of 7.8 inches was reported.

The prevailing direction of the wind was from the north, and its average velocity nearly seven miles per hour. The highest velocities, ranging from twenty-five to thirty miles per hour, occurred on the 15th and 18th.

Summary.

Temperature (in degrees Fahrenheit).—Monthly mean, 50.1; highest monthly mean, 59.8, at Port Eads; lowest monthly mean, 43.2, at Delta; maximum, 88, at New Iberia, on the 13th; minimum, 15, at Shreveport, on the 16th, and Coushatta, on the 19th; range for state, 67; greatest local monthly range, 61, at Farmersville; least local monthly range, 41, at Port Eads; greatest daily range, 47.8, at Vicksburg, Miss., on the 15th; least daily range, 1.8, at Shreveport, on the 9th.

Precipitation, including melted snow (in inches).—Average for the state, 3.17; greatest, 5.34, at Monroe; least, 1.95, at Morgan City.

The "Michigan Weather Service," N. B. Conger, Sergeant, Signal Corps, Lansing, director:

The mean temperature for January, 14°.8, is 5°.9 below the normal of thirteen years. The temperature was below the normal in all sections during January; the greatest deviation, 6°.8, was for the Upper Peninsula, and the least was 4°.6 below the normal in the northern section. The mean daily temperature was below the normal on twenty-four days and above on seven. The highest mean daily temperature, 32°, occurred on the 6th, when the temperature was 9° above the normal, and the lowest, 5° below zero, occurred on the 21st, when the temperature was 22° below the normal. The highest mean daily temperature for the past thirteen years occurred on the 1st, 1876, temperature 56°, and the lowest, 8° below zero, occurred on the 22d, 1883. The highest mean monthly temperature, 33°.7, occurred in 1880, and the lowest, 14°.5, occurred in 1881. The temperature this month is but 0°.3 above the coldest January in the past thirteen years. The maximum temperature, 46°, occurred at Coldwater, on the 6th, and lowest, 36° below zero, occurred at Sault Ste. Marie, on the 21st. Eighteen stations reported minimum temperatures of 20°, or more, below zero on the 21st. Seven cold waves passed over the state during the month, which caused a fall in temperature of from 15° to 30°; that of the 21st was the most severe, and would have undoubtedly caused much more damage if the Chief Signal Officer had not issued a timely warning, which was distributed from this office throughout the state. The mean of the maximum temperatures for the month was 22°.2, and of the minimum 6°.6. The mean range of temperature was 52°.2; absolute range, 82°.

The average amount of precipitation for January, 2.27 inches, is 0.14 above the normal of thirteen years. There was an excess of 0.19 in the Upper Peninsula, and 0.24 in the southern section, while there was a deficiency of 0.14 in the central section, and 0.47 in the northern section. The largest monthly precipitation in the past thirteen years for January, 3.01 inches, occurred in 1886, and the least, 1.27 inches, occurred in 1879. Rain fell on the evening of the 5th and on the 6th. The rainfall was heavy throughout the southern and central parts of the state on the early morning of the 6th, and froze as it fell, in many cases half an inch thick. Light rain fell during the early morning of the 7th, and was followed by snow in the afternoon. General snows fell on the 10th, 12th to 16th, 17th to 19th, 23d, 25th to 27th, while in some localities, especially in the northern portion of the state, precipitation was recorded on all days of the month except the 29th and 30th. The average amount of snow on the ground at the end of the month was 16 inches, while the total amount at individual stations varied from 6 inches in the central section to 54 inches in Upper Peninsula. The average amount of unmelted snow for the month was 21 inches. The average number of days on which 0.01 of an inch, or more, of precipitation fell in the several sections is as follows: Upper Peninsula, 18.8; northern section, 14.9; central section, 11.4; southern section, 11.1; for the state, 2.6.

The "Mississippi Weather Service," Prof. R. B. Fulton, of the University of Mississippi, Oxford, director:

The mean temperature for the month, 45°, is 1° in excess of the mean for January, 1887, and is very nearly the normal. The maximum temperature occurred on the 6th and 7th, and the minimum on the 15th, 16th, and 19th.

The average amount of rainfall for the state this month was 4.01 inches, which is 0.23 inch in excess of the average for January of last year.

Summary.

Temperature (in degrees Fahr.).—Monthly mean, 45; highest monthly mean, 53, at Biloxi; lowest monthly mean, 38, at Memphis; maximum, 78, at Vicksburg and Artonish Plantation, on the 5th and 6th; minimum, 6, at Memphis, on the 16th; range for state, 72; greatest local monthly range, 69, at West Point; least local monthly range, 44, at Biloxi; greatest daily range, 48, at Vicksburg; least daily range, 2, at Lamar.

Precipitation, including melted snow (in inches).—Average for the state, 4.01; greatest, 6.48, at Starkville; least, 1.13, at West Point.

The "Missouri Weather Service," Prof. Francis E. Nipher, of Washington University, Saint Louis, director:

The average temperature for January throughout the state was 21°.5; the highest reported was 74°, at Pro Tem, on the 4th, and the lowest, —32°, at Maryville, on the 15th. The average of maximum temperatures was 60°.6, and the average of minimum temperatures, —14°.9; an average range of 75°.5.

The average precipitation for January was 1.99 inches. It was fairly distributed over the state. The greatest amount of precipitation reported was 3.34 inches at Carthage, and the least was 0.60 inch at Ozark.

From the 7th to the 11th, and from the 12th to the 22d, severe cold waves extended over the state, the former reducing the temperature at most stations below zero, and the latter, which was one of the longest on record, reducing the temperature at all stations below the zero point. A third cold wave swept over the northern part of the state from the 24th to the 26th, but it was not severe. The first cold wave was preceded by rain, which changed to a heavy fall of sleet as the air became colder. Rain preceded, and snow and sleet accompanied, the second cold wave.

The "New Jersey Weather Service," Prof. George H. Cook, of the Agricultural College, New Brunswick, director:

Summary.

Temperature (in degrees Fahr.).—Monthly mean, 25.4; highest monthly mean, 29.2, at Ocean City; lowest monthly mean, 21.0, at Hanover; maximum, 59.0, at Freehold, on the 2d and 15th; minimum, —12, at Tenafly, on the 23d; range for state, 71.0; greatest local monthly range, 67.0, at Tenafly; least local monthly range, 46.6, at Locktown; greatest daily range, 41.0, at Freehold, on the 16th; least, 2.0, on the 3d, at Paterson and Oceanic.

Precipitation, including melted snow (in inches).—Average for the state, 4.77; greatest, 6.74, at Paterson; least, 2.80, at Salem.

Wind.—Prevailing direction, northwest.

The "North Carolina Weather Service," Dr. Herbert Battle, of Raleigh, director:

Summary.

Temperature (in degrees Fahr.).—Monthly mean, 41.4; highest monthly mean, 46.4, at Southport; lowest monthly mean, 35.6, at Lynchburg, Va.; maximum, 75.2, at Raleigh, on the 8th; minimum, 6.9, at Asheville; range for the state, 69.2; greatest local monthly range, 63.0, at Asheville; least local monthly range, 45.2, at Southport.

Precipitation, including melted snow (in inches).—Average for the state, 4.14; greatest, 6.79, at Chattanooga, Tenn.; least, 0.94, at Asheville.

Wind.—Prevailing direction, southwest.

The "Ohio Meteorological Bureau," Prof. B. F. Thomas, of the Ohio State University, Columbus, president:

The mean atmospheric pressure, 30.247 inches, is 0.109 inch above the average for the past five years, and is the highest on record for the month. The highest barometer, 30.993 inches, at Wauseon on the 6th, is not only the high-

est for January, but is the highest on record since the opening of the bureau. The lowest reading 29.423 inches, occurred at Oberlin, on the 1st.

The mean temperature of the air for the month, $23^{\circ}0$, is but 3° below the five-year average. The highest temperature, $67^{\circ}5$, occurred at Portsmouth on the 6th, and the lowest, $14^{\circ}0$ below zero, at Wauseon, on the 28th. The monthly range of temperature was $81^{\circ}5$, and the mean daily range, $16^{\circ}6$. The greatest daily range, $39^{\circ}1$, occurred at Wauseon, on the 12th, and the least, $1^{\circ}2$, at Youngstown, on the 16th.

Precipitation was general throughout the state on the 1st, 5th to 9th, 12th, 13th, 15th, 17th, 25th, and 26th. Local rains or snows occurred in the northern and middle sections on the 2d, 3d, 4th, 10th, 18th, 29th, and 31st, and in southern section on the 21st and 31st. Sleet was reported from scattering stations in all sections on the 12th, 13th, 15th, and 17th. The mean monthly rainfall, 3.68 inches, is 0.70 inch above the average for the past five years. The average daily rainfall, 0.119 inch, is 0.023 inch above the mean for the month. The greatest monthly rainfall, 6.15 inches, occurred at North Lewisburg; the least, 1.92 inches, at Youngstown. The greatest daily rainfall was 2.06, at Quaker City, on the 6th.

"Oregon Weather Service," report prepared by B. S. Pague, Sergeant, Signal Corps:

Reports were received from thirteen stations, covering the Columbia River basin, the interior valleys, coast, and southern region.

Temperature (in degrees Fahr.).—The marked characteristic of the month was the extreme low temperature. From the 2d to the 21st the temperature was generally below the normal. The coldest weather ever experienced in Oregon occurred on the 14th, 15th, and 16th. Except at the coast stations, and at Albany, the temperature was from -2 at Portland, to -34 at La Grande. Linkville and Lakeview report -24 , Eola -5 , Roseburg -6 , and Ashland -3 . The mean temperature was from 5 to 12.6 below the normal at all stations. The central coast stations report the highest mean temperature, and Roseburg reports the highest mean temperature, 35, in the interior valleys; La Grande reports the lowest mean temperature, 17. On the 22d the "chinook" wind began blowing and the temperature rose rapidly in all sections; owing to the influence of this wind, the mean temperature was raised much higher than it otherwise would have been. The maximum temperature occurred from the 25th to 31st. Roseburg reports the maximum temperature, 71. The minimum temperatures reported from the coast stations are, Astoria, 10; Newport, 0.8; Bandon, 14. The extreme cold weather of the 14th, 15th, and 16th appeared in the shape of a regular cold wave, preceded in sections by snow, and then followed by the rapid fall of the mercury. The cold wave was experienced on the entire coast, causing lower temperatures than had ever before been observed. A temperature of zero in the interior valleys of Oregon has never before been observed. The mean temperature of the state is 29.

Precipitation (in inches).—The precipitation was above the normal in all districts, the excess ranging from 0.17 at Roseburg to 5.34 at Eola. For the season, from July 1, 1887, to February 1, 1888, the precipitation is from 0.42 to 4.64 below the normal, except at Astoria and Albany, where it is above the normal. On the 28th, 29th, and 30th excessive precipitation occurred along the coast and in the Willamette Valley; on the 2d and 3d excessive precipitation occurred at Roseburg and in the southern region. Precipitation occurred on from nine to twenty days throughout the state.

The "Pennsylvania State Weather Service," report prepared under the direction of the Franklin Institute, Philadelphia, by Sergeant T. F. Townsend, Signal Corps:

The characteristics of January, 1888, were the distinctive thermal periods of abnormal warmth and cold, dividing the month into two equal parts.

The mean daily temperatures, as compared with those deduced from the records of fifteen years, show a daily excess of about 5° during the first half of the month, and a daily deficiency of about 10° during the last half. At the end of the month there was a total deficiency amounting to 49° at Pittsburgh, 106° at Philadelphia, and 179° at Erie. The mean for the month was $22^{\circ}1$, which is probably 5° below the normal; the highest occurred on the 1st and 7th, and ranged from 61° at Pittsburgh to $40^{\circ}5$ at Carlisle; the lowest were on the 22d and 23d, and the following noted: Dyberry, -19° ; Wellsborough, -16° ; Columbus, -15° ; Eagles Mere, -14° ; Greenville, -14° , and Clarion, $-18^{\circ}5$; the mean maxima for the month was $30^{\circ}2$, and the mean minima $16^{\circ}3$; these show a daily mean of $23^{\circ}2$, which is $1^{\circ}1$ above that obtained from the tri-daily observations at 7 a. m., 2 p. m., and 9 p. m.

The precipitation for the month amounted to an average of 4.19 inches,

which is nearly one inch in excess of the monthly average. Of this amount (4.19 inches) 1.40 inches was melted snow and hail. The rain and snowfall was very unevenly distributed, and ranged from 6.75 inches at Indiana, 6.17 inches at Pittsburg, 6.04 inches at Huntingdon to 2.12 inches at Chambersburg. Excepting the 14th and 22d rain or snow fell in measurable quantities on every day in some part of the state; the greatest amount, and the most rainy days, occurred in the western portion. Most of the storms were mixtures of rain, snow, and sleet.

The "South Carolina Weather Service," Hon. A. P. Butler, Com'r of Agriculture for South Carolina, Columbia, director:

The month has been unusually warm, the temperature being above the average for the month. The mean temperature for the state, $46^{\circ}2$, is $6^{\circ}1$ higher than for January, 1887. No general storm has moved directly over the state, although an area of low barometer appeared over Alabama and the Gulf on the morning of the 1st. The greatest amount of precipitation occurred on that day, the average for the state being over 1.25 inches. The average rainfall for the month (2.94 inches) is slightly higher than for same month last year; also number of days on which rain fell. The greatest amount of precipitation occurred in the middle counties.

Summary.

Temperature (in degrees Fahrenheit).—Monthly mean, 46.2; highest monthly mean, 52.5, at Hardeeville; lowest monthly mean, 43.2, at Brewer Mines; maximum, 76, at Charleston, on the 31st; minimum, 15, at Cheraw and Brewer Mines, on the 19th; range for state, 61; greatest local monthly range, 60, at Cheraw and Brewer Mines; least local monthly range, 49, at Newberry; greatest daily range, 34, at Hardeeville, on the 28th; least daily range, 2, on the 23d, at Winnsborough.

Precipitation, including melted snow (in inches).—Average for state, 2.94; greatest, 5.52, at Abbeville; least, 1.21, at Marion.

Wind.—Prevailing direction, northwest.

The following is an extract from the report of the "Meteorological Department of the State (Tennessee) Board of Health," prepared under direction of J. D. Plunket, M. D., President of the State Board of Health, by H. C. Bate, Signal Corps, Assistant, Nashville:

The month of January was marked by no special features except the remarkable sleet of the 15-16th, which remained on the ground for ten days in most parts of the state. There were no very high winds reported except at Greeneville, and only one thunder-storm, which was confined to the western division. The percentage of cloudiness was large, and while the temperature was always above zero, the month was generally a very disagreeable one.

The mean temperature was $37^{\circ}8$, about 4° above the normal for the past five years. The highest temperature was 74° , recorded on the 6th and 7th, and was the highest January maximum since 1884, when it was the same, the lowest during the period being 61° , in 1886. The lowest temperature was 2° , recorded on the 16th and 19th, and was the highest January minimum recorded in the past five years, the next being -2° , in January of last year. The lowest minimum during the period was -23° , reported at Sunbright, January 11, 1886. On that day and the day following the temperature was reported from -14° to -20° at several stations throughout the state. The mean minimum temperature for the month of that year was $-10^{\circ}74$. The ranges of temperature were generally less than usual, but in one instance—at Nashville, on the 15th—the daily range was 45° , a very unusual range.

The mean precipitation for the month was 4.47 inches, about one inch less than the January average of the past four years, and the least during that period. Of this amount the eastern division received an average of 4.76 inches, the middle division 4.20 inches, and the western division 4.45 inches. Much of this precipitation was sleet and snow, especially that portion which fell on the 15th to 20th. The days of the greatest precipitation were the 8th, 9th, 12th, 15th, 16th, and 17th, that on the last-named date being confined mostly to the eastern division. The greatest daily precipitation occurred on the 12th, and the greatest daily local precipitation was 2.18 inches, reported on the 1st at Chattanooga. There were seven days reported without measurable rainfall, viz., 2d, 3d, 19th, 24th, 26th, 27th, and 28th. The greatest monthly precipitation was 7.16 inches reported at Cookeville, and the least, was 2.40 inches, reported at Sunbright, about fifty miles east from the former station. The mean depth of snowfall was 2.79 inches. Frost was reported at various stations on twenty-seven days—the 5th, 6th, 30th, and 31st being the only days reported free from frost.

NOTES AND EXTRACTS.

CHINOOK WINDS.

[By Junior Prof. H. A. HAZEN.]

The term "Chinook" was originally applied to a south or southwesterly wind blowing over Washington Territory and British America from the region formerly inhabited by the Chinook Indians on the banks of the lower Columbia River. The name is now applied to any rather strong southwesterly to northerly wind which is warm and dry blowing to the east of the Rocky Mountains. Its lower limit, roughly speaking, is at the forty-fourth parallel, and it may extend eastward to Dakota. Its principal characteristic is the

power of melting or almost drying up the snow, as frequently no water runs from it. One of the first published notices of it to be found is in the volume of the Canadian Geological Survey, 1879-'80, page 77, by Mr. G. M. Dawson. The following are some of the more recent notes regarding it: "Science," August 29, 1884, page 166; December 25, 1885, page 556; January 8, 1886, page 33; January 15, 1886, page 55; "American Meteorological Journal," May, 1885, page 18; November, 1886, page 330; December, 1886, page 342; February, 1887, page 467; March, 1887, pages 507 and 516; August, 1887, page 182; September, 1887, page 224.

The following are some extracts from the above writings: Mr. Ingersoll

says: "On the plains about Calgary, latitude 51° N., snow disappears rapidly under the influence of the warm, dry wind sweeping up from the great Utah and Columbia basins, which people there erroneously call Chinook." Mr. G. M. Dawson says: "The Chinook is a strong westerly wind, becoming at times almost a gale, which blows from the mountains across the plains. It is extremely dry, and, as compared with the general winter temperature, warm." Professor Harrington says: "They are warm, dry westerly or northerly winds occurring on the eastern slopes of the mountains of the Northwest, beginning at any hour of the day and continuing from a few hours to several days."

The wind is generally considered by writers to be similar to the "Föhn" of the Alps, which is believed to be caused largely by the fact that an ascension of the air to the top of the mountains on the west side serves to abstract nearly all the moisture, and liberation of latent heat warms it so much that it descends on the east a warm, dry wind. This explanation for the "chinook," however, will not hold for the reason that it is felt on the plains where there are no mountain ranges near. The most remarkable circumstance is that a wind from the northwest, which ordinarily brings intense cold, brings great heat. One of the facts developed by Professor Harrington's study of the actual conditions, has been the existence of a well-developed storm or low pressure area to the northward almost without exception. This seems to increase the difficulty in obtaining a true cause for the wind, because, ordinarily, upon the passage of such a low area the westerly or northwesterly wind, while very dry, is also intensely cold as compared with that just preceding.

In order to investigate the conditions preceding these winds it was decided to take out all the cases occurring since the maps of the International Bulletin were begun. The months October to March were studied and all the cases having dry and relatively warm winds from west to north at Virginia City and Helena were selected.

Each of these instances was studied in connection with the international chart giving isobars and isotherms north of the equator. The largest number of cases occurred when there was a low area to the northward, extending far

into the Pacific; the next largest occurred with a prominent high area in the plateau between the Cascade Range and the Rocky Mountains. A few cases occurred with the high area a little farther north. The explanation, then, seems to be the prevalence of a low area to the northward, bringing in air along the southern border from the warm and arid plains and not having a reinforcement of cold air from the northward, as there is no high area in that region, but the low area extends far out upon the Pacific. The same result is brought about when the high area is to the southwestward, causing winds from the west, which are warmed in the arid plateau regions by winds from the south.

The following table shows the more pronounced of these cases:

Dates of chinook winds in northern Montana.

1877.	1880.	1882.
1. November 15.	19. January 1.	37. February 5.
2. December 8.	20. January 15.	38. February 15.
	21. January 21.	39. February 26.
	22. October 7.	40. March 1.
	23. October 20.	41. March 19.
3. January 10.	24. October 24.	42. March 27.
4. February 11.	25. November 1.	43. October 8-24.
5. February 18.		44. November 22.
6. October 22.		45. December 2.
7. March 21.		46. December 23.
8. December 2.	26. January 4.	
	27. February 2.	
	28. February 22.	
	29. March 1.	47. January 6.
9. January 24.	30. March 25.	48. November 22.
10. February 23.	31. October 7.	49. November 6.
11. February 26.	32. October 30.	50. November 29.
12. March 6.	33. November 26.	51. December 16.
13. March 29.	34. December 8.	
14. October 5.	35. December 15.	
15. October 13.		52. February 24.
16. October 26.		53. March 17.
17. November 6.		54. March 26-31.
18. December 15.		

ANNUAL SUMMARY FOR 1887.

With this REVIEW are issued two additional charts (numbers v and vi) showing respectively the annual isotherms and departures from the normal temperatures for 1887, and the annual precipitation for the same year.

As the more noteworthy meteorological features of the year, may be mentioned: 1st, the large deficiency of rainfall over the central valleys and Southern States, which resulted in the most protracted and disastrous drought that has been known for many years; 2d, the unusually warm weather which prevailed in the northern and central portions of the country east of the Mississippi River in July, during which month many stations reported the highest temperatures recorded since their establishment.

In the table below are given for the Signal Service stations for 1887, the annual mean temperatures; departures from normal temperature; maximum and minimum temperatures, with dates of occurrence; total precipitation; departures from normal, and percentages of normal precipitation. The records from which the normals are computed are not of uniform duration, but for the most part cover periods of twelve to fifteen years:

Stations and districts.	Temperature—degrees Fahrenheit.					Precipitation in inches.		
	Mean for 1887.	Departure from normal.	Extremes for 1887.			Total for 1887.	Departure from normal.	Percentage of normal.
			Maximum.	Date of maximum.	Minimum.			
<i>New England.</i>								
Eastport	41.2	-0.1	83.8	July 13	-13.4	Jan. 19	47.0	-3.5 93
Portland	44.4	-3.3	95.8	July 13	-14.7	Jan. 19	49.1	+9.3 123
Nantucket	49.2	.....	83.9	July 13	-5.2	Jan. 19	37.3	.....
Boston	48.2	0.0	95.1	July 13	-5.0	Jan. 19	33.8	-14.3 70
Block Island	49.7	+0.3	85.4	July 30	-1.8	Jan. 19	44.6	-7.3 86
New London	49.6	+0.3	80.9	July 13	-0.1	Jan. 19	48.0	-0.7 98
New Haven	48.6	-1.1	90.2	June 30	-5.4	Jan. 19	44.1	-5.8 88
<i>Middle Atlantic states.</i>								
Albany	47.6	-0.6	95.0	July 13	-15.3	Jan. 19	39.7	+1.9 105
New York City	51.9	+0.7	94.0	July 18	6.0	Jan. 19	46.6	+3.2 107
Atlantic City	51.6	-0.1	97.0	July 18	7.0	Jan. 19	37.9	-4.9 89
Philadelphia	53.8	+0.7	99.9	July 16	8.1	Jan. 3	42.2	+1.6 104
Baltimore	54.6	-0.9	101.8	July 18	7.3	Jan. 3	43.6	+1.1 103
Washington City	54.8	-0.1	103.8	July 18	6.2	Jan. 3	35.1	-8.4 81
Norfolk	58.4	-0.8	103.5	July 18	12.6	Jan. 19	47.7	-3.3 94
Lynchburg	56.4	-0.8	101.8	July 18	6.1	Jan. 4	40.6	-2.2 95

Table of annual mean, departures from normal, and maximum and minimum temperatures, &c.—Continued.

Stations and districts.	Temperature—degrees Fahrenheit.						Precipitation in inches.		
	Mean for 1887.	Departure from normal.	Extremes for 1887.			Total for 1887.	Departure from normal.	Percentage of normal.	
			Maximum.	Date of maximum.	Minimum.				
<i>South Atlantic states.</i>									
Hatteras	61.4	-0.1	89.4	July 17	10.8	Jan. 19	55.1	-18.9 74	
Raleigh	58.3	.....	103.0	July 18	8.4	Jan. 4	59.2	.....
Wilmington	63.5	-0.5	100.0	July 17, 18	14.6	Jan. 19	51.5	-6.3 89	
Charlotte	59.5	-0.8	102.2	July 18	8.2	Jan. 4	51.2	-3.5 94	
Augusta	63.6	-0.7	103.8	July 17, 18	14.7	Jan. 4	45.1	-3.9 93	
Charleston	64.9	-1.0	99.6	June 19	16.7	Jan. 4	44.7	-15.8 74	
Savannah	65.1	-1.7	101.6	July 18	16.0	Jan. 4	44.6	-9.5 82	
Jacksonville	68.1	-1.7	100.3	July 18	21.9	Jan. 4	58.6	+1.4 102	
<i>Florida Peninsula.</i>									
Cedar Keys	69.4	-1.3	92.1	July 20	24.0	Jan. 4	44.2	-14.1 76	
Key West	70.1	-1.4	89.9	July 23	50.2	Jan. 4	43.6	+3.9 110	
<i>East Gulf states.</i>									
Atlanta	61.2	-0.1	100.0	July 19	9.0	Jan. 3	50.4	-6.0 89	
Montgomery	65.5	-0.1	102.0	June 19	12.9	Jan. 3	44.7	-8.9 83	
Pensacola	68.1	+0.1	98.6	July 29	20.3	Jan. 3	52.3	-15.6 77	
Mobile	66.7	-0.2	97.5	July 29	15.9	Jan. 3	53.0	-13.8 79	
Vicksburg	66.7	+0.1	97.3	June 19	9.6	Jan. 3	42.2	-18.6 69	
New Orleans	68.4	-0.7	95.8	July 31	21.4	Jan. 3	65.0	+0.6 101	
<i>West Gulf states.</i>									
Fort Smith	60.8	+1.8	103.8	July 31	-4.0	Jan. 3	38.7	-4.3 90	
Shreveport	60.0	+0.5	103.8	July 31	12.0	Jan. 3	42.2	-12.2 78	
Palestine	65.1	+0.6	101.5	July 22	10.6	Dec. 21	38.0	-7.9 83	
San Antonio	68.1	-1.0	100.9	June 1	16.8	Jan. 3	26.1	-12.4 62	
Galveston	69.7	-0.4	93.4	July 23	23.5	Jan. 10	43.4	-9.6 82	
<i>Rio Grande Valley.</i>									
Rio Grande City	72.8	-0.5	108.3	May 1	25.0	Jan. 10	32.2	+9.2 140	
Brownsville	71.1	-2.5	92.7	Aug. 17, 26	26.2	Dec. 22	59.9	+27.0 152	
<i>Tennessee.</i>									
Nashville	59.8	+0.3	99.3	Aug. 3	-1.8	Jan. 2	48.4	-4.5 91	
Memphis	61.9	-0.9	99.0	July 31	4.3	Jan. 3	42.5	-12.2 78	
Chattanooga	60.1	-0.1	99.2	July 19	7.4	Jan. 2	51.1	-8.3 86	
Knoxville	58.8	+1.6	100.2	July 19	5.4	Jan. 3	43.0	-11.0 80	
<i>Ohio Valley.</i>									
Pittsburg	54.1	+2.2	101.2	July 17	4.0	Jan. 4, 19	42.0	+5.3 114	
Columbus	52.8	+0.7	100.2	July 17	-5.0	Jan. 2, 11	30.2	-12.1 71	
Indianapolis	52.6	-0.2	100.8	July 30	-11.8	Jan. 3	33.1	-13.4 71	
Cincinnati	55.3	-0.3	101.2	July 18	-5.2	Jan. 3	35.1	-8.0 81	
Louisville	57.7	+1.0	101.7	July 29	-4.7	Jan. 2	38.2	-10.8 78	
<i>Lower lake region.</i>									
Detroit	48.4	+0.3	101.0	July 17	-3.0	Jan. 11	29.0	-5.4 85	
Toledo	48.8	-1.2	98.6	July 17	-10.3	Jan. 11	32.0	-0.8 98	
Sandusky	49.3	-1.1	98.0	July 17	-8.0	Jan. 11	29.9	-9.7 75	
Cleveland	49.3	+0.5	95.2	July 17	-5.9	Jan. 11	35.4	-2.8 93	
Erie	48.1	-1.0	93.6	Aug. 4	-3.5	Jan. 11	45.1	+1.7 104	
Buffalo	48.8	+0.4	94.2	Aug. 4	-1.7	Jan. 18	31.6	-6.5 83	
Rochester	46.3	-0.4	95.0	July 16	-4.6	Jan. 18	20.3	-15.9 59	
Oswego	45.2	-1.9	90.4	July 16	-9.6	Jan. 8	23.4	-12.1 66	

Table of annual mean, departures from normal, and maximum and minimum temperatures, &c.—Continued.

Stations and districts.	Temperature—degrees Fahrenheit.						Precipitation in inches.		
	Extremes for 1887.								
	Mean for 1887.	Departure from normal.	Maximum.	Date of maximum.	Minimum.	Date of minimum.			
<i>Upper lake region.</i>									
Duluth	37.3	-2.2	94.8	July 15	-27.8	Jan. 30	28.6	-4.5	86
Marquette	39.0	-1.7	97.0	July 15	-20.6	Jan. 31	25.6	-7.4	78
Escanaba	39.4	-0.5	85.5	July 15	-24.4	Jan. 31	23.0	-12.3	65
Milwaukee	44.6	-0.2	99.9	July 16	-15.9	Jan. 7	30.5	-3.2	91
Chicago	47.7	-0.8	99.8	July 16	-15.3	Jan. 3	29.1	-9.7	77
Grand Haven	45.7	-0.9	90.9	Aug. 10	-7.3	Feb. 1	32.8	-6.8	83
Mackinaw City	39.9	+0.6	89.0	July 8	-14.4	Jan. 31	15.1	-21.3	41
Alpena	40.6	-0.3	92.8	Aug. 4	-15.7	Jan. 31	37.9	+0.2	103
Green Bay	43.0	-0.6	98.4	July 16	-28.8	Jan. 7	32.6	.....	.....
Port Huron	45.2	+0.3	99.1	July 17	-9.0	Jan. 11	24.8	-9.8	72
Lansing	48.9	-0.7	99.7	July 17	-14.0	Jan. 7	31.5	.....	.....
<i>Extreme Northwest.</i>									
Fort Buford	37.7	-0.3	90.4	June 25	-45.2	Jan. 1	15.4	+0.7	104
Bismarck	38.0	-1.4	96.8	June 15	-43.6	Jan. 2	16.3	-4.4	79
Fort Totten	34.1	.....	91.2	June 6, 14	-39.0	Jan. 6	19.4	.....	.....
Moorehead	36.5	-0.2	95.5	May 10	-47.5	Jan. 8	22.0	-5.9	79
Saint Vincent	33.3	+0.1	96.0	May 10	-44.1	Dec. 29	18.5	-0.4	98
<i>Up. Mississippi valley.</i>									
Saint Paul	42.1	-1.7	93.9	July 15	-35.7	Jan. 18	25.8	-3.4	88
La Crosse	45.0	-1.5	95.4	July 16	-25.9	Jan. 7	17.4	-16.7	51
Dubuque	47.4	-0.4	100.6	July 16	-31.5	Jan. 7	34.4	-5.4	86
Des Moines	48.2	-0.2	101.7	July 29	-24.5	Jan. 7	24.6	-16.8	59
Keokuk	51.4	-0.2	100.0	Aug. 10	-18.5	Jan. 7	26.3	-11.6	69
Springfield	52.8	+0.2	99.7	July 29	-18.2	Jan. 2	25.2	-20.9	55
Saint Louis	57.5	-2.2	100.0	July 17	-9.6	Jan. 2	35.3	-3.0	92
Cairo	58.2	+2.0	97.5	July 30	-1.1	Jan. 2	26.8	-18.9	59
<i>Missouri Valley.</i>									
Fort Sully	43.9	.....	103.7	July 14	-28.5	Jan. 8	14.3	.....	.....
Yankton	45.3	-0.2	98.7	Aug. 9	-29.1	Jan. 8	27.1	-1.3	95
Huron	41.0	-0.8	99.2	July 14	-32.8	Jan. 8	25.3	+1.0	104
Omaha	49.0	-0.5	103.3	July 20	-21.9	Jan. 2, 6	19.9	-16.6	54
Leavenworth	52.7	-0.4	101.7	July 17	-15.5	Jan. 9	37.0	-2.0	94
Lamar	55.2	-0.9	99.0	July 30	-18.1	Jan. 9	35.7	.....	.....
Valentine	45.1	-0.2	97.2	July 14	-31.5	Nov. 27	18.0	.....	.....
<i>Northern slope.</i>									
Fort Assinabine	39.6	-1.7	93.1	July 6	-55.4	Feb. 3	18.9	+4.8	133
Helena	41.9	-1.3	91.5	July 6	-40.5	Feb. 2	14.0	-1.3	91
Fort Custer	43.7	-0.4	102.6	June 25	-34.0	Feb. 11	12.2	-1.8	88
Poplar River	36.3	.....	100.7	June 20	-44.8	Feb. 3	15.5	.....	.....
Fort Maginnis	40.6	+0.2	91.3	July 6	-42.0	Feb. 2	26.0	+13.9	215
Deadwood	42.8	+1.2	92.4	June 25	-29.0	Feb. 3	31.7	+5.2	120
North Platte	47.6	0.0	99.8	Aug. 9	-25.2	Nov. 28	21.7	+2.1	111
<i>Middle slope.</i>									
Denver	50.3	+1.1	95.9	June 25	-17.6	Jan. 8	12.5	-3.6	83
Dodge City	53.6	+0.9	101.8	Aug. 10	-17.0	Jan. 9	14.2	-7.2	66
Las Animas	52.3	+2.8	99.8	Aug. 7	-18.0	Jan. 9	13.5	-0.2	99
Fort Elliott	56.5	+1.9	98.7	July 21	-5.4	Nov. 27	22.8	-1.8	92
Concordia	51.7	.....	102.4	July 29	-18.7	Jan. 9	25.3	.....	.....
<i>Southern slope.</i>									
Abilene	63.7	.....	101.3	July 20	6.3	Jan. 8, 9	24.6	.....	.....
Fort Davis	60.5	+0.5	94.2	July 25	1.3	Dec. 23	18.5	-1.0	95
Fort Stanton	49.8	.....	91.0	July 24	-18.2	Dec. 22	16.8	.....	.....
<i>Southern plateau.</i>									
Prescott	53.6	+1.4	97.0	June 23	7.5	Dec. 22	17.4	+2.0	113
Fort Grant	60.5	-0.4	98.6	June 24	7.4	Dec. 22	24.3	+8.2	150
Fort Apache	54.9	+2.6	102.0	June 24	1.1	Dec. 22	17.8	-4.8	78
El Paso	63.6	+0.4	103.0	July 25	-2.4	Dec. 23	6.8	-5.6	55
Keeler	60.8	.....	99.2	June 22	22.0	Feb. 20	5.0	.....	.....
<i>Middle plateau.</i>									
Salt Lake City	52.7	+1.5	97.9	July 6	8.7	Dec. 21	11.7	-5.6	68
Montrose	48.6	.....	93.6	July 6	-16.2	Dec. 22	9.6	.....	.....
Fort Bidwell	47.6	.....	94.0	July 5	-2.0	Feb. 20	16.5	.....	.....
Fort Bridger	41.6	.....	87.0	June 26	-18.1	Dec. 21	8.9	.....	.....
Frisco	49.8	.....	90.0	July 6	0.4	Dec. 21	7.1	.....	.....
Winnemucca	49.2	-0.2	97.7	June 22	-3.4	Nov. 26	8.0	-1.9	81
<i>Northern plateau.</i>									
Spokane Falls	47.2	-0.1	97.3	Aug. 17	-11.0	Feb. 3	20.1	-1.6	92
Boise City	51.4	.....	100.3	July 6	5.6	Nov. 26	11.3	.....	.....
Walla Walla	52.6	-0.7	95.7	May 30	-3.0	Feb. 7	20.4	.....	.....
<i>N. Pac. coast region.</i>									
Olympia	49.2	-0.3	93.2	June 21	2.4	Feb. 5	61.8	+7.6	114
Portland	53.0	-0.5	99.0	May 29	9.1	Feb. 4	54.2	+1.8	103
Roseburg	53.4	-0.2	102.0	May 29	7.0	Feb. 5	57.3	+2.2	106
Fort Canby	48.8	.....	90.7	June 21	13.8	Feb. 4	73.8	.....	.....
Port Angeles	45.0	.....	81.5	Aug. 11	2.6	Feb. 5	34.2	.....	.....
Tatoosh Island	47.4	.....	69.6	Sept. 6	14.8	Feb. 2	105.1	.....	.....
<i>Mid. Pac. coast region.</i>									
Red Bluff	64.4	+2.0	111.5	July 8	27.3	Nov. 27	13.6	-14.6	48
Sacramento	59.9	+0.5	100.0	June 19	28.0	Nov. 27	13.4	-9.8	58
San Francisco	55.5	+0.6	96.9	May 26	33.1	Feb. 5	19.0	-4.9	79
<i>S. Pac. coast region.</i>									
Los Angeles	61.7	+0.9	100.1	June 16	33.1	Jan. 12	16.3	-1.0	94
San Diego	60.6	0.0	85.0	Oct. 29	35.5	Dec. 22	10.4	+1.4	114
Yuma	72.9	+1.0	115.5	June 23	27.1	Dec. 23	3.9	+1.4	156

The data here presented shows that the year 1887 was colder than the average in the northern districts of the country, along the Gulf coast, and in the Atlantic coast states to the south of New Jersey, while in California, the central and southern Rocky Mountain districts, and over a belt of country extending thence

east-northeast to the New Jersey coast, the annual mean temperatures were above the normal. At but few stations have the departures exceeded 2°, or even amounted to as much as 1°, and it may be said that the year 1887, with respect to temperature, more nearly approached the normal than either of the two preceding years (1885 and 1886), for which annual summaries of temperature and rainfall have been published.

In 1885 the departures (below) from the normal temperature exceeded 2° over nearly all the country east of the Mississippi, and numerous stations showed deficiencies exceeding 4°, while in the Rocky Mountain districts and on the Pacific coast the departures (above normal) were equally as marked.

In 1886, the departures from normal temperature were not so marked as those for the preceding year, but they were greater than for 1887, and in the Southern States deficiencies exceeding 3° occurred at some of the Gulf stations.

The following are the most marked departures from the normal for 1887 at stations where records exceed twelve years:

	Above normal.	Below normal.
Pittsburg, Pa.	2.2	0
Saint Louis, Mo.	2.2	2.2
Cairo, Ill.	2.0	1.9
Knoxville, Tenn.	1.6	1.7
Oswego, N. Y.	1.5	1.7
Salt Lake City, Utah.	1.5	1.5
Denver, Colo.	1.1	1.5

The distribution of rainfall for the year 1887 is exhibited on chart number vi, in the preparation of which records from about eight hundred stations have been used.

In the following table are given the normal and current annual mean temperatures and rainfalls, departures, and extremes for past years, as reported from voluntary stations:

Stations.	Temperature.				Precipitation.			
	Normal.	Number of years.	Mean for 1887.	Departure.	Highest mean.	Lowest mean.	Normal.	Number of years.
California.	60.0	22	57.0	-3.0	63.0	1275	57.0	1883
Illinois.	53.0	20	53.1	-0.2	55.3	1878	50.5	1869
Sandwich.	45.0	38	50.5	+5.5	50.7	1863	.....	.....
Iowa.	52.9	20	53.1	-0.2	55.3	1878	50.5	1869
Kansas.	53.0	7	53.0	0.0	53.0	1869	34.7	1860
Lawrence.	52.9	20	53.1	-0.2	55.3	1878	50.5	1869
Yates Centre.	53.0	7	53.0	0.0	53.0	1878	34.7	1860
Maine.	53.0	20	53.1	-0.2	55.3	1878	34.7	1860
Gardiner.	44.0	49	43.0	-1.0	44.6	1877	34.7	1860
Maryland.	51.4	16	51.4	0.0	53.0	1875	50.0	1869
Cumberland.	51.4	16	51.4					

and southern California there was a marked excess; and on the middle Pacific coast the annual rainfall ranged from 50 to 75 per cent. of the average.

From chart vi it will be seen that the yearly rainfall on the north Pacific coast reaches 100 inches (Tatoosh Island, Wash., reporting 106 inches) and that it falls below 5 inches over portions of the middle and southern plateau districts and southern California.

The following notes on the meteorological features of the year are also furnished by voluntary observers:

California.—Santa Barbara, Santa Barbara Co.: during the year there were but twenty-six days on which the temperature rose to 80° ; of these, twelve occurred either before April 1st or after October 1st, leaving but fourteen for the summer season.

Georgia.—Mr. Samuel A. Cook, observer at Milledgeville, states: From an agricultural point of view the year 1887 was unfavorable for nearly all crops, owing to alternate droughts and freshets, the ill effects of which can only be understood from a study of the record in detail, as the yearly rainfall is fully up to the normal. The rainfall of July, 1887, 16.09 inches, was the heaviest monthly fall ever known at this place.

Kansas.—Prof. F. H. Snow of the University of Kansas, furnishes the following meteorological summary for 1887, from observations taken at Lawrence:

The year was marked by a cold winter and a warm spring, while the summer and autumn were of nearly the average temperatures. The total rainfall fell but little short of the average amount, but its distribution was unfavorable to corn and other midsummer crops. A serious deficiency in July found the ground nearly destitute of moisture, on account of the eleven-inch deficiency of the year 1886, and in less than two weeks what promised to be the most abundant corn crop ever produced in the state was reduced to very small proportions. The abundant crops of oats, hay, potatoes, and other spring and autumn products gave the state of Kansas a great advantage over other states which suffered from a more serious drought without similar compensations.

Other characteristics of the year were the small percentage of cloudiness, the moderate wind-velocity, and the astonishingly low barometer of February 3d, the lowest barometric reading on our twenty-years' record.

The mean temperature of the winter months, $26^{\circ}.3$, is $2^{\circ}.6$ below the average winter temperature; of the spring, $56^{\circ}.3$, is $2^{\circ}.7$ above the average; of the summer, $75^{\circ}.8$, is $0^{\circ}.1$ below the average; of the autumn, 54° , is $0^{\circ}.1$ above the average.

The warmest month of the year was July, with mean temperature $79^{\circ}.8$; the warmest week was July 11th to 17th, mean $86^{\circ}.8$; the warmest day was July 17th, mean $89^{\circ}.5$. The mercury reached, or exceeded, 90° on forty days (just the average number), viz., one in May, five in June, eighteen in July, ten in August, and six in September. There was only one day on which the temperature reached 100° , July 17th.

The coldest month was January, with mean temperature $20^{\circ}.5$; the coldest week was January 1st to 7th, mean temperature $4^{\circ}.4$ above zero; the coldest day was January 8th, mean $7^{\circ}.1$ below zero. The mercury fell below zero on sixteen days—nine in January, three in February, and four in December.

The last severe frost of spring was on April 4th; the first severe frost of autumn was on the 24th of October, giving an interval of two hundred and three days, or nearly seven months with severe frosts; the average interval is one hundred and ninety-eight days.

New Jersey.—The following summary for 1887, is furnished by Prof. George H. Cook, director of the state weather service.

Temperature (in degrees Fahrenheit).—Annual mean, 51.1 ; maximum, 102.0 , at Matawan, July 8th, and Clayton, July 16th; minimum, 4.5 below zero, at Dover, January 8th; range for state 106.5 ; mean winter temperature, 32.6 ; mean spring temperature, 47.9 ; mean summer temperature, 71.7 ; mean autumn temperature, 52.1 .

Precipitation, including melted snow (in inches).—Average monthly rainfall for the state, 4.01 ; greatest annual, 53.31 , at Somerville; least annual, 37.91 , at Atlantic City; greatest monthly, 14.00 , at Matawan, July; least monthly, 0.08 , at Matawan, May.

Precipitation by seasons (in inches).—Winter, 18.63 ; departure from the normal, $+3.36$. Autumn, 8.04 ; departure from the normal, -3.64 . Summer, 18.46 ; departure from the normal, $+5.60$. Spring, 7.53 , departure from the normal, -4.29 .

New York.—Mexico, Oswego Co.: the following is from the "Mexico Independent" of January 25, 1888: the year 1887 was marked with an excessively cold January, a long, hot summer, a dry atmosphere, light winds and clear skies. But the most remarkable characteristic of the year was the very light rainfall; during the spring months, March, April, and May, the rainfall was 4.05 inches below the average, and for the year there was a deficiency of 8.24 inches.

Ohio.: Prof. B. F. Thomas, director of the Ohio Meteorological Bureau, gives the following summary for the state:

The mean temperature, $51^{\circ}.4$, is the highest annual mean since the bureau was established. The maximum temperature, 108° , at Pomeroy, on July 18th, is also the highest temperature on record, and is 7° higher than the maximum for July 21, 1885, at the Ohio State University. The lowest temperature reported during the year was -21° , at Paulding, on January 7th.

The rainfall, 33.63 inches, is 6.36 inches below the normal for the state. Rain fell on 120.9 days, which is 17 days below the average.

The year is remarkable from having the highest barometer, the highest maximum temperature, the highest mean temperature, and the smallest rainfall on record since the opening of the bureau.

Table showing monthly and annual mean temperatures at Grampian Hills, Clearfield Co., Pa., from observations made by Messrs. Elisha Fenton, Jonathan Kirk, and Nathan Moore.

[Temperature in degrees Fahrenheit.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual mean.
1864	18.5	25.0	38.0	47.0	57.3	72.0	69.8	57.7	45.6	36.3	27.0	.....
1865	22.5	24.4	31.0	48.3	53.3	66.0	72.4	62.1	59.5	37.8	37.1	45.3	
1866	16.1	30.3	29.0	45.0	48.0	67.5	67.9	67.2	59.4	46.7	23.8	47.5	
1867	19.2	16.6	32.6	36.9	52.2	63.9	75.8	68.0	56.6	43.5	22.1	44.7	
1868	26.5	27.7	41.6	51.7	63.5	66.8	67.3	59.3	39.2	26.1	26.1	43.3	
1869	27.2	22.1	45.8	59.1	68.0	70.9	66.6	60.4	47.7	34.0	23.2	46.2	
1870	23.3	24.0	36.4	46.4	57.8	66.2	67.3	70.0	54.2	47.5	30.9	21.3	45.3
1871	20.0	20.2	44.0	50.2	66.1	70.7	68.9	56.9	44.5	29.3	16.1	43.2	
1872	19.4	20.2	26.3	41.5	54.7	68.5	64.4	56.6	44.3	34.1	20.8	44.0	
1873	30.1	27.7	31.0	36.1	55.2	69.1	71.0	65.7	64.2	47.5	35.2	29.0	47.0
1874	17.0	15.0	28.0	29.0	56.6	66.2	69.3	65.6	57.5	47.2	35.3	25.1	42.7
1875	33.5	27.3	30.0	40.6	54.4	69.3	72.0	71.3	57.4	43.5	38.3	16.0	46.1
1876	20.7	30.0	29.3	44.1	55.0	66.5	70.9	69.3	61.8	53.6	39.1	37.0	45.1
1877	31.0	40.4	52.2	55.0	61.3	74.0	70.0	61.0	51.2	37.4	23.4	45.6	
1878	21.3	29.3	34.3	41.8	59.0	66.4	72.0	67.1	58.2	56.4	37.9	32.0	47.2
1879	35.0	31.7	45.3	65.7	65.0	73.2	68.4	61.7	48.0	36.3	19.6	47.8	
1880	19.5	22.0	32.8	40.7	59.0	63.5	72.0	73.1	72.0	55.0	31.1	34.5	47.9
1881	22.1	32.0	40.0	42.8	50.0	66.2	68.6	68.8	65.3	55.0	34.5	23.0	47.0
1882	32.0	35.4	42.8	50.0	60.0	62.2	65.6	65.3	55.0	34.5	20.5	47.0	
1883	19.0	24.0	45.0	43.3	56.0	68.0	70.8	68.0	58.5	47.5	37.3	26.3	45.1
1884	17.0	26.0	30.7	41.0	53.5	65.3	66.6	68.3	66.0	51.7	35.7	25.6	44.3
1885	17.8	13.7	20.1	41.2	57.0	65.8	72.1	66.6	59.8	44.4	33.6	24.2	43.0
1886	19.5	22.8	32.8	51.0	61.5	65.8	70.0	68.0	65.8	50.4	35.2	21.5	47.0
1887	22.1	30.3	39.5	44.0	65.1	68.4	76.8	65.6	59.0	45.4	35.8	26.0	47.4
Mean.	22.4	24.5	30.4	43.0	56.4	66.3	70.8	67.7	60.6	48.0	34.9	25.1	45.7

Table showing monthly and annual precipitation at Grampian Hills, Clearfield Co., Pa., from observations made by Nathan Moore.

[Precipitation in inches and hundredths.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1864	6.24	3.43	4.53	3.63	5.11	3.37	6.18	3.13	2.07	3.57	48.00	.....
1865	2.55	3.30	4.70	3.14	1.58	3.25	5.67	4.08	4.21	3.83	48.37	48.37	
1866	2.72	3.46	4.50	4.36	7.17	1.31	4.21	4.14	1.49	2.88	2.10	4.54	43.04
1867	3.34	3.79	4.00	4.56	5.91	2.74	3.35	3.56	6.36	2.82	3.26	3.00	46.67
1868	5.13	2.34	4.56	3.68	5.18	7.28	5.68	2.21	3.96	1.81	3.27	4.94	49.43
1869	5.16	4.54	4.00	1.35	5.61	2.83	6.63	3.23	2.78	4.58	1.54	3.29	45.54
1870	3.56	2.43	2.70	3.84	2.07	3.16	4.12	3.70	1.27	2.88	4.70	1.99	36.42
1871	1.21	1.56	2.00	2.03	2.84	4.59	6.44	3.94	1.67	4.20	1.43	5.12	37.03
1872	4.64	4.24	4.75	4.81	3.58	5.29	4.73	6.88	1.76	4.74	2.66	4.35	50.07
1873	4.29	3.29	3.20	3.84	5.00	6.14	7.14	7.33	4.37	6.03	2.94	4.23	42.63
1874	4.27	1.90	3.62	3.44	3.87	4.93	5.47	2.93	4.50	0.97	6.03	2.94	44.86
1875	3.50	2.03	6.89	2.41	1.81	3.57	4.73	4.63	2.90	2.19	3.00	3.58	41.34
1876	4.70	4.08	2.92	.....	.....	.....	2.26	.....	.....	2.55	.....	.....	.....
1882	6.85	2.60	4.38	4.27	6.17	6.05	1.66	2.24	2.89	2.55	3.75	47.67	
1883	3.29	4.59	5.10	3.00	2.86	9.85	5.29	4.07	2.14	3.76	1.82	3.05	49.52
1884	3.82	2.23	1.34	3.63	4.06	2.96	6.14	8.03	1.14	2.92	3.73	2.72	42.72
1885	4.27	1.90	3.62	3.44	3.87	4.93	5.47	2.92	4.50	0.97	6.03	2.94	44.86
1887	2.57	7.63	2.49	3.26	3.38	7.02	3.55	3.05	3.50	0.81	2.28	3.12	43.85
Mean.	3.66	3.54	3.98	3.51	3.72	4.51	5.07	4.04	3.22	2.78	2.99	3.68	44.78

Table showing monthly and annual mean temperatures and precipitation at Collinsville, Ill., from observations made by Dr. J. L. R. Wadsworth.

[Temperature in degrees Fahrenheit.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual mean.
1880	42.3	35.5	41.6	56.1	68.8	72.8	75.5	75.3	65.6	53.5	30.5	24.6	53.7
1881	17.6	26.0	39.9	50.8	69.4	74.7	80.7	77.2	74.7	60.5	41.1	39.7	54.5
1882	30.6	44.5	46.9	58.1	60.0	74.7	73.4	74.5	67.3	60.3	44.3	30.9	55.4
1883	22.3	30.2	38.4	55.0	61.4	71.0	73.8</td						

Meteorological record of voluntary observers and Army post surgeons, January, 1888.

The maximum and minimum temperatures at stations marked thus (*) are from readings of other than standard instruments.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	Stations.	Temperature. (Fahrenheit.)			Precipitation.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
				Inches		Inches			
Alabama.	°	°	°	Inches	Indiana—Cont'd.	°	°	°	Inches
Livingston.	74	20	46.0	4-33	Vevay.	65	8	29.9	4-20
Mt. Vernon B'ks.	77	20	52.7	2-39	Indian Territory.				
Newmarket.	69	19	39.3	5-62	Gibson, Fort.	74	-10	32.5	0-54
Arizona.					Reno, Fort.	69	-13	28.7	0-43
Huachuca, Fort.	65	21	.....	0-10	Supply, Fort. Arizona.	75	-15	.....	0-30
McDowell, Fort.	79	25	.....	0-77	Albia.	45	-25	13.0	1-95
Mojave, Fort.	73	14	55.0	.....	Ames.	39	-32	0-5	1-06
Arkansas.					Auburn.	40	-19	7.9	4-47
Hot Springs.	9	39.0	5-80		Bancroft.	40	-36	0-7	1-45
Lead Hill.	74	-2	31.9	2-54	Cedar Rapids.	37	-32	9.2	1-39
British Columbia.					Clear Lake.	38	-36	2.5	4-49
New Westminster.	54	2	27.9	7-11	Clinton.	36	-31	8.4	1-59
California.					Cresco.	35	-43	0-8	1-74
Alcatraz Island.	59	28	45.2	6-6	Dysart.	32	-20	6.8	1-75
Angel Island.	61	27	45.4	5-16	Eau Moines.	44	-32	6.5	T.
Banning.	74	22	.....	0-19	Fairfield.	35	-26	10.5	.....
Bidwell, Fort.	50	-25	.....	3-0	Fort Madison.	46	-22	.....	1-50
E. Pasadena.	70	26	48.7	6-55	Glenwood a.	58	-33	6.7	.....
Gaston, Fort.	65	5	36.2	12-52	Glenwood b.	45	-40	10.0	.....
Georgetown.	63	11	38.0	12-52	Humboldt.	36	-35	6.4	0-79
Hydesville.	18	39	14-81		Independence.	35	-29	4.8	1-49
Lewis Creek*.	70	24	47.0	4-09	Logan.	45	-35	7.2	1-50
Mason, Fort.	62	30	47.6	6-11	Manson.	44	-34	.....
Nicolaus *	65	18	43.2	4-97	Maquoketa.	49	-35	0-71	
Oakland.	61	26	45.4	6-42	Monticello.	39	-31	6.7	1-13
Orovile.	65	20	45.4	7-73	Mount Vernon*.	39	-33	5.9	.....
Presidio of San F.	64	32	45.7	7-18	Muscatine.	39	-39	9.6	4-49
Riverside.	74	26	47.4	4-38	Osceola.	40	-34	.....	1-15
Sacramento.	64	16	39.4	5-37	Oskaloosa a.	47	-31	9.1	1-18
Salinas.	63	22	44.9	4-15	Oskaloosa b.	34	-29	.....
Santa Barbara.	66	26	49.0	10-11	Sac City.	35	-29	1.8	1-45
Willows.	63	17	41.8	3-18	Smithland.	.....	.....	0-57	
Colorado.					West Bend.	37	-36	0-4	4-60
Grand Junction*.	50	-20	18.9	0-98	Wesley.	.....	.....	1-60	
Lewis, Fort.	55	-28	20.1	0-38	Washington.	42	-25	9.8	1-26
Connecticut.					Kansas.				
Hartford.	51	-20	13.5	7-68	East Norway*.	51	-20	20.5	4-50
New Hartford.	43	-17	11.7	3-22	Elk Falls.	69	-13	.....	1-13
Southington.	48	-19	17.0	4-78	Emporia.	60	-17	39.0	0-00
Voluntown.	55	-16	21.3	6-75	Globe.	56	-26	19.6	0-95
Dakota.					Hays, Fort.	66	-22	19.1	2-00
A. Lincoln, Fort.	45	-36	-5.5	0-90	Independence.	70	-13	24.4	1-28
Garden City.	49	-35	3-3	0-40	Manhattan.	54	-29	12.1	0-65
Meade, Fort.	61	-34	14.1	1-65	Morse*.	52	-34	25.3	1-10
Parkston.	42	-26	3-2	0-60	Ninnescah.	71	-19	19.0	0-75
Pembina, Fort.	30	-51	.....	0-17	Riley, Fort.	56	-26	16.8	0-26
Randall, Fort.	46	-30	6.0	0-20	Saline*.	51	-12	23.7	0-03
Richardton.	41	-37	4-2	4-00	Wakefield*.	60	-24	18.0	0-53
Sisseton, Fort.	38	-38	-6.8	0-25	Wellington.	61	-10	20.6	0-65
Sully, Fort.	53	-31	0.8	0-37	Yates Centro.	65	-16	20.9	1-60
Totten, Fort.	40	-12.4	1-19		Tribune.	.....	19.7	0-35	
Webster.	43	-38	-1.7	2-29	Kentucky.				
Yates, Fort.	49	-34	0-09		Bowling Green*.	72	8	33.3	6-15
District of Columbia.					Carlisle.	27	5	2.5	2-35
Distribut'g res'r'r.	53	8	29.9	2-60	Frankfort.	69	6	4-60	.....
Kendall Green.	46	8	26.8	2-90	Louisiana.				
Receiving res'r'r.	52	8	29.6	3-73	Grand Coteau.	75	25	51.6	2-70
Aqueduct office*.	55	10	32.5	.....	Liberty Hill.	74	23	49.5	3-78
Florida.					Luling.	78	30	3-09	.....
Alva*.	82	37	62.0	0-10	Maine.				
Archer.	85	22	.....	0-87	Bar Harbor.	56	-10	.....	4-81
Duke.	80	33	55.6	0-68	Cornish.	33	-16	10.8	4-85
Fort Meade*.	83	36	60.0	T	Gardiner.	47	-13	12.3	5-13
Homeland*.	82	39	65.1	0-15	Orono.	47	-20	8.6	4-97
Limona*.	84	36	65.2	0-52	Skowhegan.	35	-25	5.7	4-11
Manatee.	83	36	63.0	0-30	Maryland.				
Merritt's Island.	80	40	63.4	0-74	Cumberland.	48	4	26.6	3-85
Saint Augustine.	79	30	57.0	0-10	Fallston.	45	2	25.8	4-80
Tallahassee.	78	25	55.5	1-15	Great Falls*.	52	9	29.6	3-09
Georgia.					McDonogh.	50	5	26.7	3-13
Andersonville.	77	18	50.4	4-76	McHenry, Fort.	49	7	.....	1-42
Athens.	75	16	43.5	4-53	New Midway*.	44	4	26.7	4-17
Forsyth*.	78	20	50.4	6-34	Woodstock.	54	4	27.2	4-19
Marietta.	71	12	43.4	.....	Amherst a.	43	-17	15.4	4-36
Milledgeville*.	71	19	47.0	6-30	Amherst b.	41	-22	13.8	3-87
Quitman.	77	26	55.7	1-50	Deerfield.	40	-23	11.7	6-24
Idaho.					Dudley.	54	-14	16.3	2-67
Boise Barracks.	56	-26	18.0	1-76	Fall River.	55	-5	20.1	0-19
Lewiston.	51	-20	1.5	1-58	Milton.	53	8	.....	3-15
Sherman, Fort.	46	-34	16.3	5-77	Newport.	50	9	19.7	4-21
Illinois.					North Volney.	45	-11	14.1	.....
Collinville.	64	-10	22.5	1-93	Paiermo*.	44	-13	11.6	3-53
Charleston*.	59	-12	21.3	2-97	Plattsburg B'ks.	45	-18	10.5	0-59
Monmouth.	52	-18	16.9	3-01	Palmira.	48	-9	18.2	.....
Oswego.	40	-22	12.3	1-46	Penn Yan.	.....	1-61	.....
Pekin.	50	-19	16.0	2-40	Saratoga Springs.	.....	4-27	.....
Palestine.	58	-8	23.5	1-75	Setauket.	56	2	24.0	5-49
Rockford.	38	-26	9.1	1-72	Syracuse.	49	-13	.....
Sandwich*.	45	-24	14.8	1-45	Utica.	40	-21	12.4	4-32
South Evanston.	39	-20	.....	1-40	West Point.	52	-15	4-56	4-56
Sycamore.	39	-22	10.3	1-01	White Plains.	50	-17	22.2	5-34
Windsor.	58	-13	20.2	2-70	North Carolina.				
Indiana.					Chapel Hill.	75	16	39.4	3-37
Butlerville*.	66	2	36.8	2-77	Hot Springs.	71	14	45.0	.....
Jeffersonville.	68	4	30.1	3-89	Raleigh.	78	19	42.0	3-90
Laconia.	66	5	26.7	3-68	Statesville*.	68	15	38.9	5-07
Logansport*.	54	-19	20.0	3-50	Weldon*.	72	13	37.7	3-83
Mauzy.	58	-3	21.9	3-83	Ohio.				
Sumner*.	39	1	25.3	2-83	Cleveland.	55	-2	23.0	2-57
					Hudson.	57	3	20.6	3-50
					Kalamazoo.	36	-3	16.5	1-89
					Jacksonville.	55	-15	20.1	3-48
					Garrisonville.	54	-5	20.9	3-18
					Hiram.	54	-5	20.9	3-18
					Jacksonborough.	64	0	23.6	3-85
					Lordstown.	54	-2	22.6	2-73
					Napoleon.	40	-2	22.4	2-23
					New Athens.	54	-2	.....

Meteorological record of voluntary observers, etc.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	Stations.	Temperature. (Fahrenheit.)			Precipitation.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
				Inches		Inches			
Minnesota.	°	°	°	Inches	Ohio—Cont'd.	°	°	°	Inches
Delano.	37	-52	-1.7	3-06	North Lewisburg.	57	-1	24.1	6-15
Excelsior.	36	-47	0-3	2-90	Portsmouth.	68	8	31.7	4-49
Glenwood.	35	-40	-3.3	0-29	Ruggles*.	53	-5	22.2	3-20
Le Sueur.	39	-47							

Table of miscellaneous meteorological data for January, 1888—Signal Service observations.

Stations and districts.	Elevation above sea-level, feet.	Atmospheric pressure, in inches and hundredths.						Temperature of the air, in degrees Fahrenheit.						Winds.																				
		Mean actual barometer.			Extremes.			Monthly mean.			Extremes.			Daily ranges.			Mean relative humidity, per cent.			Maximum velocity.														
		Mean reduced barometer.	Highest barometer.	Date.	Lowest barometer.	Date.	Monthly range of barometer.	Max.	Departure from normal.	Min.	Greatest.	Date.	Least.	Mean min.	Monthly range.	Mean point, degrees Fahrenheit.	Departure from normal precipitation, in inches.	Total movement, miles.	Prevailing direction.	Miles p. h.	Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.									
New England.								17.2	7.1	45.8	23.0	-12.225	4.559	0.42	1.13	8.4	28.71.6	6.0	4.25	+ 0.05	5.08	1.04	11.308	n.w.	56	se.	26	14	7	12	12			
Eastport.	53	29.90	-0.06	29.96	30.78	13	28.80	27.1	1.98	13.7	6.3	46.8	2	23.0	-12.225	6.259	0.35	5.1	3.5	10.74.7	7.3	6.05	+ 3.43	5.478	n.w.	36	s.	26	14	8	12	11		
Portland.	99	29.94	-0.01	30.04	30.85	12	28.99	26	1.86	14.3	9.7	46.7	1	22.4	-12.329	5.529	0.35	5.5	3.5	10.74.7	5.5	3.70	+ 0.33	5.339	n.w.	36	w.	26	15	5	13	13		
Manchester.	247	29.81	-0.01	30.10	30.84	12	29.13	26	1.71	14.2	9.8	41.515	23.4	-10.523	5.523	3.33	9.15	6.4	19.70.0	5.5	5.39	+ 0.33	5.339	n.w.	36	w.	26	15	5	13	13			
Northfield.	871	29.10	-0.01	30.13	30.82	12	29.42	26	1.40	7.1	9.9	41.13	18.7	-24.125	2.965	5.56	5.70	7.3	4.75.1	0.5	4.99	+ 0.49	5.258	n.w.	51	n.	26	17	9	12	10			
Boston.	125	29.96	+ 0.01	30.10	30.85	12	29.10	26	1.75	20.0	-0.6	57.0	2	26.7	-2.229	11.403	2.39	8.13	4.1	10.71.0	11.0	2.26	+ 2.20	10.417	n.w.	52	n.w.	26	11	7	12	12		
Edgartown.								24.2	7.1	51.4	21.3	-4.029	17.155	4.27	0.23	5.9	8.8	2.82	2.82	2.82	n.w.													
Nantucket.	14	30.07	-0.07	30.08	30.81	12	29.14	26	1.67	25.3	-0.3	54.5	2	33.1	-3.529	17.156	0.31	1.1	6.0	31.80	19.8	3.48	+ 0.51	10.558	n.w.	52	s.	26	13	8	12	11		
Wood's Holl.	22	30.10	-0.01	30.12	30.85	12	29.14	26	1.71	21.9	-0.2	53.6	2	30.5	-3.929	13.356	5.35	6.1	6.0	28.93	20.2	3.66	+ 0.15	6.518	n.w.	54								
Vineyard Haven.								29.9	-	59.9	1	44.9	-	7.020	15.066	9.47	9	1	6.4	20	...	3.05	...	n.w.	54	s.	26	12	4	17	10			
Block Island.	26	30.08	+ 0.03	30.10	30.82	12	29.23	26	1.59	24.6	-5	52.2	3	32.7	-3.022	13.58	0.34	4.13	5.5	28.80	19.1	2.12	-3.66	15.009	n.w.	54	s.	26	12	4	17	10		
Narragansett Pier.								23.4	-	55.0	1	32.5	-	5.029	14.260	5.24	0.13	7.0	2.98	...	5.33	-0.48	n.w.											
New Haven.	107	30.02	+ 0.03	30.14	30.85	12	29.36	26	1.49	20.5	-5	53.2	2	28.5	-4.422	12.757	6.32	4.13	8.0	28.75	13.8	3.48	+ 1.30	6.651	n.w.	36	s.	1	13	7	14	10		
New London.	47	30.06	-0.01	30.11	30.81	12	29.27	26	1.54	23.3	-5	57.5	1	32.0	-3.022	14.959	5.33	8.13	7.7	28	76.1	16.3	3.78	+ 0.35	6.447	n.w.	48	s.	26	12	5	12	14	
Mid. Atlantic States.								28.7	-	3.7	15.2	21.8	-2.1	1.39	29.48	26.1	1.39	1.1	1.923	7.1	2.7	4.77.8	9.4	3.81	-0.07	5.244	n.w.	40	n.w.	26	17	12	13	6
Albany.	85	30.08	+ 0.04	30.18	30.87	12	29.48	26	1.39	15.2	-0.2	45.1	2	23.1	-9.923	7.155	0.41	0.1	2.7	4.77.8	9.4	3.81	-0.19	5.244	n.w.	40	n.w.	26	17	12	13	6		
New York City.	135	29.95	-0.02	30.16	30.83	12	29.46	26	1.37	25.9	-4	51	2	33.1	1.922	18.852	3.27	1.13	6.0	31.70.9	17.2	5.14	-1.30	10.170	w.	60	w.	26	14	10	13	8		
Philadelphia.	117	30.07	-0.05	30.20	30.83	12	29.52	26	1.21	28.0	-0.1	51	2	35.4	-2.422	20.353	8.29	0.1	8.3	9.71.4	19.3	2.12	-0.91	6.337	n.w.	36	w.	26	15	11	14	6		
Atlantic City.	34	30.16	-0.06	30.19	30.83	12	29.59	26	1.24	28.3	-3	57	4	38.5	-3.522	21.050	9.32	0.25	8.3	8.3178.1	22.1	3.95	-0.05	8.058	n.w.	46	n.	26	11	6	15	10		
Baltimore.	45	30.17	-0.05	30.23	30.83	12	29.72	26	1.11	29.1	-0.1	51.7	2	37	19.0	22.740	4.21	0.20	5.4	6.068	4.4551	n.w.	30	w.	26	11	11	14	6					
Washington City.	106	30.11	-0.05	30.23	30.85	12	29.75	26	1.10	29.2	-0.1	52.8	2	38.5	9.228	22.744	3.22	0.20	8.6	8.71.2	21.2	2.99	-0.45	4.321	n.w.	30	w.	26	10	8	18	5		
Cape Henry.								35.6	-	72.1	7	48.8	-	1.028	30.955	0.30	4.16	8.6	14	...	4.12	-0.54	n.w.											
Lynchburg.	652	29.49	+ 0.05	30.21	30.79	12	29.49	25	1.00	35.6	-0.4	73.7	4	44.4	14.012	26.959	7.33	1.30	8.6	23.63.3	22.8	2.99	-1.36	2.823	n.w.	27	n.w.	26	10	8	15	8		
Norfolk.	30	30.18	+ 0.05	30.21	30.79	12	29.70	25	1.06	35.1	-1	7.9	6	47.3	3.029	9.5	2.922	7.89	31.0	4.42	+ 0.47	5.977	e.	29	sw.	13	14	10	14	7				
S. Atlantic States.								45.9	-	80.1	1	40.9	-	1.049	65.6	1.5	1.6	2.7	2.93	1.04	...	2.93	-1.04	n.w.										
Charlotte.	806	29.34	+ 0.05	30.21	30.63	10	29.81	1	0.82	42.0	-0.1	73.8	7	52.7	17.219	32.955	6.34	0.1	8.1	1.17	72.2	32.4	1.99	-1.49	3.607	sw.	24	sw.	1	14	11	12	8	
Hatteras.	11	30.23	+ 0.09	30.22	30.72	12	29.70	25	0.66	44.7	-0.3	69.0	2	30.5	28.5	38.946	5.256	0.18	7.8	2.12	6.442	1.45	...	1.45	-1.11	8	13	11	12	8				
Raleigh.	375	29.92	-0.02	30.23	30.77	12	29.86	1	0.91	40.0	-0.1	75.2	8	48.9	16.819	31.958	4.39	0.2	7.5	2.528	7.80	3.1	3.98	-0.05	4.989	n.w.	25	w.	18	10	13	11	7	
Southport.								46.4	-	64.2	1	54.1	-	19.019	38.548	5.247	0.15	5.0	0.1	1	2.76	-0.97	n.w.											
Wash Woods.								40.2	-	73.4	8	47.7	-	17.028	32.856	4.27	0.16	4.5	1.510	...	3.39	-1.20	n.w.											
Wilmington.	52	30.17	+ 0.06	30.23	30.79	12	29.89	25	0.81	46.5	-1	75.1	7	50.3	20.019	37.155	1.32	0.3	8.5	17.72.8	39.5	2.21	-1.72	5.403	n.w.	27	sw.	1	17	9	9	13		
Charleston.	52	30.19	+ 0.08	30.24	30.88	12	29.91	27	0.67	51.0	-1	70.0	3	60.0	26.019	42.650	0.28	0.13	5.0	14.79.6	40.4	1.95	-2.27	5.815	w.	32	no.	18	6	9	8	15		
Columbia.								47.0	-	71.8	7	55.2	-	21.321	36.453	5.33	0.20	6.4	2.30	...	3.37	-1.88	8.485	e.	33	nw.	18	7	3	13	5			
Augusta.	183	30.17	+ 0.06	30.27	30.80	12	29.85	1	0.75	45.5	-1	77.1	8	57.8	22.619	38.555	2.32	0.15	6.2	2.327	6.373	3.8	-0.23	0.33	...	9.11	9	11	11	7				
Sav																																		

Table of miscellaneous meteorological data for January, 1888—Signal Service observations—Continued.

Stations and districts.	Elevation above sea level, feet.	Atmospheric pressure, in inches and hundredths.						Temperature of the air, in degrees Fahrenheit.												Winds.											
		Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes.	Highest barometer.	Dates.	Lowest barometer.	Dates.	Monthly range of barometer.	Monthly mean.	Departure from normal.	Dates.	Max.	Extremes.	Dates.	Mean max.	Monthly range.	Greatest.	Date.	Least.	Date.	Mean min.	Daily ranges.	Mean relative humidity, per cent.	Mean temperature of dew-point, degrees Fahrenheit.	Precipitation, in inches.	Departure from normal precipitation, in inches.	Total movement, miles.	Miles p. h.	Prevailing direction.	Maximum velocity.
<i>Upper Miss. Valley.</i>																															
Saint Paul.....	831	29.30	+ 14	30.27	30.83	15	29.46	1	1.37	12.5	8.6	- 10.9	34.0	30	9.5	- 41.2	21	- 10.275	2.35	5.13	6.5	5.78	7	6.3	0.14	3,618	W.	25	8.	25 10 9 16 6	
La Crosse.....	744	29.44	- 17	30.30	30.96	16	29.37	1	1.59	2.6	- 11.3	34.0	6	12.0	- 42.0	21	- 7.476	0.39	0.13	7.7	14.85	4	1.0	1.44	+ 0.20	4,738	S.	27	S.	24 12 6 18 7	
Davenport.....	615	29.56	- 11	30.28	30.95	16	29.61	1	1.34	9.7	- 11.3	51.5	4	20.0	- 24.5	15	0.665	0.55	0.13	8.0	29.84	4	5.7	1.54	+ 0.18	5,469	N.W.	39	S.W.	1 8 7 14 10	
Des Moines.....	866	29.32	- 13	30.30	30.95	16	29.59	1	1.36	6.9	- 11.1	43.8	31	16.0	- 27.4	15	1.771	2.32	9.24	6.8	20.81	8	2.3	1.15	+ 0.12	5,419	N.W.	30	W.	13 5 4 13 14	
Dubuque.....	665	29.52	- 14	30.29	30.96	16	29.52	1	1.44	7.0	- 10.0	37.0	31	16.7	- 30.5	16	2.567	5.48	4.14	4.0	6.74	8	0.89	1.20	+ 0.52	2,486	N.W.	25	W.	13 6 10 9 12	
Keokuk.....	618	29.55	- 09	30.26	30.95	15	29.63	1	1.32	13.6	- 8.4	53.2	6	24.3	- 23.0	15	5.076	2.54	6.13	5.2	20.74	4	6.8	1.57	+ 0.10	5,619	N.W.	36	W.	13 7 3 15 13	
Cairo.....	359	29.59	- 10	30.29	30.88	15	29.91	1	1.94	31.7	- 2.3	72.6	6	40.5	- 0.3	16	24.572	9.37	6.7	6.9	30.73	2	23.5	2.80	+ 1.24	7,191	N.L.	40	W.	4 15 11 11 9	
Springfield.....	644	29.56	- 11	30.27	30.99	15	29.74	1	1.25	17.5	- 8.5	53.3	2	27.0	- 17.0	15	8.870	2.40	8.13	8.5	10.77	1	11.5	3.03	+ 1.08	6,847	N.W.	13	7 7 16 8		
Saint Louis.....	577	29.63	- 09	30.28	30.94	15	29.76	1	1.18	24.3	- 3.7	67.8	4	34.1	- 11.5	15	16.279	3.35	2.13	6.0	17.75	4	17.2	2.15	+ 0.02	8,800	N.W.	52	S.W.	4 9 7 11 13	
<i>Missouri Valley.</i>																															
Lamar.....	1,028	29.17	- 00	30.32	30.94	15	29.68	1	1.26	25.3	- 2.7	66.7	4	34.8	- 12.5	15	16.279	2.40	0.6	6.2	9.77	4	18.6	2.18	+ 0.41	8,528	S.W.	36	SW.	4 8 9 13 9	
Springfield.....	1,356	28.76	- 10	30.27	30.91	15	29.71	1	1.20	27.5	- 0.5	67.8	4	38.7	- 11.0	15	18.078	8.39	3.13	8.3	30.77	6	20.6	1.42	+ 0.12	8,171	S.E.	36	N.	15 13 10 7 14	
Leavenworth.....	842	29.37	- 12	30.31	30.98	15	29.58	1	1.40	16.3	- 7.7	54.9	31	26.0	- 21.1	15	7.676	0.32	5.12	2.6	14.73	9	5.1	0.93	+ 0.41	4,865	N.	30	N.W.	13 5 6 15 10	
Topeka.....	1,113	29.07	- 12	30.34	30.98	15	29.53	1	1.45	8.0	- 9.0	51.1	31	17.3	- 10.7	15	1.070	5.38	1.26	4.3	10.73	1	1.0	0.58	+ 0.00	6,057	N.W.	42	N.W.	13 4 5 10 16	
Omaha.....	1,113	29.07	- 12	30.34	30.98	15	29.53	1	1.45	8.0	- 9.0	51.1	31	17.3	- 10.7	15	1.070	5.38	1.26	4.3	10.73	1	1.0	0.58	+ 0.00	6,057	N.W.	42	N.W.	13 4 5 14 12	
Crete.....																															
Valentine.....	2,614	27.37	- 00	30.26	30.88	15	29.48	1	3.40	8.7	- 6.3	63.4	21	29.5	- 34.6	15	4.608	0.48	6.12	2.0	1.0	0.04	+ 0.20	7,868	N.W.	56	D.	12 3 3 11 17			
Fort Sully.....	1,600	28.45	+ 03	30.28	30.84	14	29.60	1	1.24	1.5	- 6.5	50.2	31	13.7	- 31.7	16	9.181	0.49	8.9	7	0.13	7.89	3	3.8	0.37	+ 0.21	6,062	W.	12	5	6 10 15
Huron.....	1,307	28.79	- 11	30.31	30.89	14	29.66	1	1.23	1.4	- 7.4	39.7	26	9.5	- 36.0	15	12.175	7.41	1	9.5	1.87	6	4.4	0.78	+ 0.55	8,866	N.W.	60	N.W.	12 7 4 17 10	
Yankton.....	1,234	28.89	- 11	30.30	30.94	15	29.51	1	1.41	4.6	- 8.4	49.6	30	15.2	- 27.5	15	5.577	1.41	6.26	6	1.14	7.48	8	0.37	- 0.18	+ 0.18	6,742	N.W.	54	N.W.	12 7 6 12 13
<i>Northern slope.</i>																															
Fort Assinaboine.....	2,720	27.22	- 04	30.24	30.80	19	29.69	1	28.11	5.0	- 7.5	53.0	26	10.8	- 38.0	21	9.991	3.56	8.25	5.6	1.3	4.6	9.6	0.40	- 0.77	8,645	S.W.	48	D.	11 10 10 13 8	
Fort Custer.....	3,040	26.90	- 09	30.26	30.88	14	29.55	1	1.33	4.4	- 9.6	54.0	26	15.5	- 45.1	14	7.599	1.55	5.1	6.1	22.76	5	2.3	0.39	+ 0.67	4,758	S.E.	49	N.	12 7 8 16 6	
Fort Maginnis.....	4,340	25.48	- 05	30.10	30.66	14	29.48	1	1.12	11.5	- 4.5	59.8	31	23.6	- 39.2	13	0.799	0.61	0.12	9.128	74.9	4	3.77	- 0.95	+ 0.93	4,924	N.W.	68	N.W.	12 7 11 16 4	
Helema.....	4,069	25.84	- 05	30.22	31.06	14	29.53	1	1.31	5.3	- 11.7	56.5	30	17.9	- 3.9	15	3.979	5.66	5.12	7.0	20.65	6	5.6	0.79	+ 0.89	2,989	S.W.	48	W.	26 8 7 17 7	
Poplar River.....	2,030	27.97	- 09	30.28	30.80	14	29.61	1	1.19	10.0	- 6.0	44.0	31	4.3	- 50.8	9	3.886	4.37	8.2	7.2	14.65	5	1.53	0.15	+ 0.21	3,404	W.	42	D.W.	12 7 4 15 12	
Cheyenne.....	6,105	23.91	+ 02	30.08	30.83	14	29.40	1	1.43	24.0	- 0.0	63.0	27	36.1	- 27.2	14	1.979	2.40	0.6	6.1	7.72	9	3.4	0.29	+ 0.01	9,758	N.W.	52	N.W.	12 7 4 14 16	
Laramie.....																															
North Platte.....	2,841	27.17	- 08	30.27	30.93	15	29.54	1	1.39	12.7	- 6.3	66.2	26	26.5	- 34.6	15	0.5	40	8.18	10.0	573	1	4.6	0.09	- 0.40	5,505	N.W.	46	N.W.	12 3 1 11 19	
Rapid City.....	2664	26.64	- 00	30.18	30.90	15	29.62	1	1.26	10.9	- 1.0	66.0	31	23.6	- 29.7	14	2.895	7.48	4	9.11	7	0.75	2	4.33	2,426	W.	29	n.	24 4 2 15 14		
<i>Middle slopes.</i>																															
Colorado Springs.....	5,281	24.70	+ 04	30.10	30.82	15	29.33	1	1.49	27.3	- 1.7	76.0	27	4.3	- 20.3	15	10.685	9.56	6.21	9.5	4.55	3	9.10	0.11	+ 0.53	5,903	S.	60	N.W.	12 4 3 7 21	
Pike's Peak.....	14,134	17.13	- 09	30.04	30.89	17	29.41	1	1.48	4.8	- 8.8	54.5	27	10.7	- 22.8	17	8.484	1.27	0.12	2.5	15.47	8	9.26	0.26	+ 0.67	4,758	S.E.	96	N.W.	17 4 0 15 16	
Las Animas.....	3,800	26.06	+ 05	30.16	30.94	15	29.45	1	1.49	24.6	- 3.6	70.7	26	43.1	- 17.8	15	8.886	5.55	0.22	9.20	22.55	2	7.06	- 0.06	+ 0.23	4,966	N.	36	N.E.	13 3 4 12 15	
Concordia.....	1,384	28.73	- 00	30.28	30.97	15	29.49	1	1.48	15.5	- 7.5	61.1	30	26.2	- 25.15	15	3.886	4.37	8.2	7.2	14.65	5	0.5								

Table showing maximum and minimum temperatures, and monthly and annual mean temperatures at Newark, N. J., from May, 1843, to December, 1887, both inclusive, from observations of Mr. Frederick W. Ricord.

[Temperature in degrees Fahrenheit.]

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	Mean Max. Min.	Mean Max. Min.	Mean Max. Min.	Mean Max. Min.	Mean Max. Min.	Mean Max. Min.	Mean Max. Min.	Mean Max. Min.	Mean Max. Min.	Mean Max. Min.	Mean Max. Min.	Mean Max. Min.
1843.	59.0	65.0	22.0	54.3	62.0	34.0	56.9	38.0	60.2	92.4	38.2	72.9
1844.	59.5	69.0	31.0	54.7	65.0	34.0	56.7	51.0	71.3	86.7	56.2	63.6
1845.	59.0	69.0	31.0	54.7	65.0	34.0	56.6	52.5	49.7	70.9	88.0	35.5
1846.	59.0	69.0	31.0	54.7	65.0	34.0	56.5	52.5	49.7	70.9	88.0	35.5
1847.	59.0	69.0	31.0	54.7	65.0	34.0	56.4	52.5	49.7	70.9	88.0	35.5
1848.	59.0	69.0	31.0	54.7	65.0	34.0	56.3	52.5	49.7	70.9	88.0	35.5
1849.	59.0	69.0	31.0	54.7	65.0	34.0	56.2	52.5	49.7	70.9	88.0	35.5
1850.	59.0	69.0	31.0	54.7	65.0	34.0	56.1	52.5	49.7	70.9	88.0	35.5
1851.	59.0	69.0	31.0	54.7	65.0	34.0	56.0	52.5	49.7	70.9	88.0	35.5
1852.	59.0	69.0	31.0	54.7	65.0	34.0	55.9	52.5	49.7	70.9	88.0	35.5
1853.	59.0	69.0	31.0	54.7	65.0	34.0	55.8	52.5	49.7	70.9	88.0	35.5
1854.	59.0	69.0	31.0	54.7	65.0	34.0	55.7	52.5	49.7	70.9	88.0	35.5
1855.	59.0	69.0	31.0	54.7	65.0	34.0	55.6	52.5	49.7	70.9	88.0	35.5
1856.	59.0	69.0	31.0	54.7	65.0	34.0	55.5	52.5	49.7	70.9	88.0	35.5
1857.	59.0	69.0	31.0	54.7	65.0	34.0	55.4	52.5	49.7	70.9	88.0	35.5
1858.	59.0	69.0	31.0	54.7	65.0	34.0	55.3	52.5	49.7	70.9	88.0	35.5
1859.	59.0	69.0	31.0	54.7	65.0	34.0	55.2	52.5	49.7	70.9	88.0	35.5
1860.	59.0	69.0	31.0	54.7	65.0	34.0	55.1	52.5	49.7	70.9	88.0	35.5
1861.	59.0	69.0	31.0	54.7	65.0	34.0	55.0	52.5	49.7	70.9	88.0	35.5
1862.	59.0	69.0	31.0	54.7	65.0	34.0	54.9	52.5	49.7	70.9	88.0	35.5
1863.	59.0	69.0	31.0	54.7	65.0	34.0	54.8	52.5	49.7	70.9	88.0	35.5
1864.	59.0	69.0	31.0	54.7	65.0	34.0	54.7	52.5	49.7	70.9	88.0	35.5
1865.	59.0	69.0	31.0	54.7	65.0	34.0	54.6	52.5	49.7	70.9	88.0	35.5
1866.	59.0	69.0	31.0	54.7	65.0	34.0	54.5	52.5	49.7	70.9	88.0	35.5
1867.	59.0	69.0	31.0	54.7	65.0	34.0	54.4	52.5	49.7	70.9	88.0	35.5
1868.	59.0	69.0	31.0	54.7	65.0	34.0	54.3	52.5	49.7	70.9	88.0	35.5
1869.	59.0	69.0	31.0	54.7	65.0	34.0	54.2	52.5	49.7	70.9	88.0	35.5
1870.	59.0	69.0	31.0	54.7	65.0	34.0	54.1	52.5	49.7	70.9	88.0	35.5
1871.	59.0	69.0	31.0	54.7	65.0	34.0	54.0	52.5	49.7	70.9	88.0	35.5
1872.	59.0	69.0	31.0	54.7	65.0	34.0	53.9	52.5	49.7	70.9	88.0	35.5
1873.	59.0	69.0	31.0	54.7	65.0	34.0	53.8	52.5	49.7	70.9	88.0	35.5
1874.	59.0	69.0	31.0	54.7	65.0	34.0	53.7	52.5	49.7	70.9	88.0	35.5
1875.	59.0	69.0	31.0	54.7	65.0	34.0	53.6	52.5	49.7	70.9	88.0	35.5
1876.	59.0	69.0	31.0	54.7	65.0	34.0	53.5	52.5	49.7	70.9	88.0	35.5
1877.	59.0	69.0	31.0	54.7	65.0	34.0	53.4	52.5	49.7	70.9	88.0	35.5
1878.	59.0	69.0	31.0	54.7	65.0	34.0	53.3	52.5	49.7	70.9	88.0	35.5
1879.	59.0	69.0	31.0	54.7	65.0	34.0	53.2	52.5	49.7	70.9	88.0	35.5
1880.	59.0	69.0	31.0	54.7	65.0	34.0	53.1	52.5	49.7	70.9	88.0	35.5
1881.	59.0	69.0	31.0	54.7	65.0	34.0	53.0	52.5	49.7	70.9	88.0	35.5
1882.	59.0	69.0	31.0	54.7	65.0	34.0	52.9	52.5	49.7	70.9	88.0	35.5
1883.	59.0	69.0	31.0	54.7	65.0	34.0	52.8	52.5	49.7	70.9	88.0	35.5
1884.	59.0	69.0	31.0	54.7	65.0	34.0	52.7	52.5	49.7	70.9	88.0	35.5
1885.	59.0	69.0	31.0	54.7	65.0	34.0	52.6	52.5	49.7	70.9	88.0	35.5
1886.	59.0	69.0	31.0	54.7	65.0	34.0	52.5	52.5	49.7	70.9	88.0	35.5
1887.	59.0	69.0	31.0	54.7	65.0	34.0	52.4	52.5	49.7	70.9	88.0	35.5
1888.	59.0	69.0	31.0	54.7	65.0	34.0	52.3	52.5	49.7	70.9	88.0	35.5
1889.	59.0	69.0	31.0	54.7	65.0	34.0	52.2	52.5	49.7	70.9	88.0	35.5
1890.	59.0	69.0	31.0	54.7	65.0	34.0	52.1	52.5	49.7	70.9	88.0	35.5
1891.	59.0	69.0	31.0	54.7	65.0	34.0	52.0	52.5	49.7	70.9	88.0	35.5
1892.	59.0	69.0	31.0	54.7	65.0	34.0	51.9	52.5	49.7	70.9	88.0	35.5
1893.	59.0	69.0	31.0	54.7	65.0	34.0	51.8	52.5	49.7	70.9	88.0	35.5
1894.	59.0	69.0	31.0	54.7	65.0	34.0	51.7	52.5	49.7	70.9	88.0	35.5
1895.	59.0	69.0	31.0	54.7	65.0	34.0	51.6	52.5	49.7	70.9	88.0	35.5
1896.	59.0	69.0	31.0	54.7	65.0	34.0	51.5	52.5	49.7	70.9	88.0	35.5
1897.	59.0	69.0	31.0	54.7	65.0	34.0	51.4	52.5	49.7	70.9	88.0	35.5
1898.	59.0	69.0	31.0	54.7	65.0	34.0	51.3	52.5	49.7	70.9	88.0	35.5
1899.	59.0	69.0	31.0	54.7	65.0	34.0	51.2	52.5	49.7	70.9	88.0	35.5
1900.	59.0	69.0	31.0	54.7	65.0	34.0	51.1	52.5	49.7	70.9	88.0	35.5
1901.	59.0	69.0	31.0	54.7	65.0	34.0	51.0	52.5	49.7	70.9	88.0	35.5
1902.	59.0	69.0	31.0	54.7	65.0	34.0	50.9	52.5	49.7	70.9	88.0	35.5
1903.	59.0	69.0	31.0	54.7	65.0	34.0	50.8	52.5	49.7	70.9	88.0	35.5
1904.	59.0	69.0	31.0	54.7	65.0	34.0	50.7	52.5	49.7	70.9	88.0	35.5
1905.	59.0	69.0	31.0	54.7	65.0	34.0	50.6	52.5	49.7	70.9	88.0	35.5
1906.	59.0	69.0	31.0	54.7	65.0	34.0	50.5	52.5	49.7	70.9	88.0	35.5
1907.	59.0	69.0	31.0	54.7	65.0	34.0	50.4	52.5	49.7	70.9	88.0	35.5
1908.	59.0	69.0	31.0	54.7	65.0	34.0	50.3	52.5	49.7	70.9	88.0	35.5
1909.	59.0	69.0	31.0	54.7	65.0	34.0	50.2	52.5	49.7	70.9	88.0	35.5
1910.	59.0	69.0	31.0	54.7	65.0	34.0	50.1	52.5	49.7	70.9	88.0	35.5
1911.	59.0	69.0	31.0	54.7	65.0	34.0	50.0	52.5	49.7	70.9	88.0	35.5
1912.	59.0	69.0	31.0	54.7	65.0	34.0	49.9	52.5	49.7	70.9	88.0	35.5
1913.	59.0	69.0	31.0	54.7	65.0	34.0	49.8	52.5	49.7	70.9	88.0	35.5
1914.	59.0	69.0	31.0	54.7	65.0	34.0	49.7	52.5	49.7	70.9	88.0	35.5
1915.	59.0	69.0	31.0	54.7	65.0	34.0	49.6	52.5	49.7	70.9	88.0	35.5
1916.	59.0	69.0	31.0	54.7	65.0	34.0	49.5	52.5	49.7	70.9	88.0	35.5
1917.	59.0	69.0	31.0	54.7	65.0	34.0	49.4	52.5	49.7	70.9	88.0	35.5
1918.	59.0	69.0	31.0	54.7	65.0	34.0	49.3	52.5	49.7	70.9	88.0	35.5
1919.	59.0	69.0	31.0	54.7	65.0	34.0	49.2	52.5	49.7			

Table showing maximum, minimum, and mean monthly temperatures at Saint Louis, Mo., furnished by Dr. George Engelmann.

(Temperature in degrees Fahrenheit.)

MONTHLY WEATHER REVIEW.

Year,	January.			February.			March.			April.			May.			June.			July.			August.			September.			October.			November.		
	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean			
1837..	54	5*	26.6	61*	19*	38.7	69*	18*	41.7	87*	25*	49.6	86*	38*	63.4	86*	58*	73.1	80.1	64	86.4	91	92	43	66.6	67	67	34.7	59	1			
1838..	65	7	34.7	49	5	20.8	85	26	50.5	93	30	49.5	94	43	75.7	101	91	54	74.3	86	85	64.4	78	24	35.5	62.8	49	35.5	49	6			
1839..	71	13	37.2	67	8	38.5	78	5	45.0	84	40	66.8	93	46	67.3	93	58	75.6	97	58	66.1	78	20	42.7	62	14	36.0	62	14				
1840..	49	6	26.3	81	10	39.8	67	22	47.2	86	38	61.1	88	46	66.2	93	58	75.9	94	55	66.1	77	22	54.3	70	20	46.1	62	16				
1841..	60	-11	28.6	65	1	32.9	76	26	46.1	82	38	54.9	93	45	66.2	97	52	77.1	95	48	66.1	77	22	54.3	70	20	46.1	62	16				
1842..	66	16	38.7	67	2	37.4	86	28	56.7	88	43	63.0	93	42	66.8	95	45	73.7	99	54	75.8	95	52	73.3	98	24	42.7	62	14				
1843..	72	0	38.7	60	-1	25.4	55	16	47.2	86	26	46.5	97	42	67.7	94	55	75.6	95	55	75.6	97	28	54.4	76	20	44.6	64	10				
1844..	59	11	38.9	66	17	41.2	86	26	46.7	87	35	54.7	95	43	67.7	94	55	75.6	97	51	77.4	98	48	54.4	76	20	44.6	64	10				
1845..	65*	23*	40.6	73*	16*	44.1	75*	20*	45.4	91*	24*	64.3	86*	51*	57.7	74.7	55*	79.8	93*	61*	77.6	95*	53*	74.0	79.5	20	42.7	53*	-1*				
1846..	61*	21*	38.7	75*	12*	38.2	75*	20*	47.2	84*	31*	59.0	86*	50*	59.0	93*	53*	70.8	98*	53*	70.8	98*	60*	53*	74.0	19*	45.4	65*	18*				
1847..	66*	0*	27.2	66*	12*	38.2	75*	20*	47.2	84*	31*	59.3	87*	50*	59.3	94*	54*	70.8	98*	54*	70.8	98*	54*	53*	74.0	19*	45.4	65*	18*				
1848..	64*	-4*	39.4	73*	12*	40.4	75*	20*	47.2	84*	31*	59.2	91*	49*	44*	69.0	99*	55*	72.5	95*	59*	73.5	94*	58*	55*	74.0	19*	45.4	65*	18*			
1849..	64*	1*	39.0	60*	26*	31.2	75*	20*	47.2	84*	29*	54.7	88*	39*	54.7	94*	59*	75.4	99*	52*	74.7	98*	53*	73.8	98*	24	42.7	62*	2*				
1850..	64*	12*	37.2	74*	-1*	37.7	75*	23*	43.8	84*	23*	54.7	90*	28*	54.7	96*	54*	76.0	98*	62	80.8	102*	60	81.5	94*	23*	47.8	62	2*				
1851..	64*	1*	35.4	76*	14*	38.5	78*	23*	48.5	86*	34*	54.4	92*	29*	54.4	96*	54*	73.4	98*	54*	73.4	98*	64*	56*	74.0	23*	40.8	64*	10*				
1852..	65*	-12	38.1	66*	14	38.5	78*	19*	48.0	81*	29	53.0	94*	42	67.4	94	57	78.6	99*	56*	73.9	99*	64*	56*	74.0	23*	35.0	64*	10*				
1853..	64*	9*	34.8	69*	4*	34.1	81*	21*	43.4	82*	37	50.8	91*	41	64.0	94*	56*	76.4	99*	56*	75.4	99*	64*	56*	74.0	23*	34.3	64*	10*				
1854..	65*	6*	34.8	70*	16*	39.2	80*	26*	47.0	88*	35*	57.2	90*	26*	47.0	97	49*	76.7	99*	57	76.0	99*	65*	66*	74.0	23*	37.0	65*	10*				
1855..	65*	3*	33.6	67*	5*	39.2	71*	14*	39.2	93*	32*	52.4	93*	32*	52.4	93*	53*	62.4	99*	60*	71.7	99*	60*	71.7	99*	61*	61*	74.0	23*	37.0	65*	10*	
1856..	65*	3*	33.6	67*	5*	39.2	71*	14*	39.2	93*	32*	52.4	93*	32*	52.4	93*	53*	62.4	99*	60*	71.7	99*	60*	71.7	99*	61*	61*	74.0	23*	37.0	65*	10*	
1857..	53*	-14*	26.6	66*	10*	36.2	75*	20*	47.2	84*	29*	54.7	88*	39*	54.7	94*	59*	75.4	99*	52*	76.5	99*	52*	76.5	99*	52*	52*	74.0	23*	37.0	65*	10*	
1858..	65*	46*	13*	74*	5*	41.8	75*	10*	39.5	72*	18*	44.4	88*	40*	61.8	92	57*	74.8	98*	56*	75.6	98*	57*	75.6	98*	56*	56*	74.0	23*	37.0	65*	10*	
1859..	63*	26*	40.5	55*	0*	37.2	75*	11*	47.8	84*	34*	57.7	88*	44*	60	96*	56*	76.5	98*	57*	76.5	98*	57*	76.5	98*	57*	57*	74.0	23*	37.0	65*	10*	
1860..	65*	59*	1*	33.5	75*	8*	37.8	28*	48.9	82*	29	52.3	86*	37	59.0	93*	54*	76.3	98*	58*	76.8	98*	58*	76.8	98*	58*	58*	74.0	23*	37.0	65*	10*	
1861..	64*	48*	1*	33.8	63*	2*	37.6	75*	25*	59.7	86*	37	59.0	93*	44	72.1	94	58*	76.3	98*	58*	76.3	98*	58*	76.3	98*	58*	58*	74.0	23*	37.0	65*	10*
1862..	64*	4*	39.4	74*	14*	39.8	74*	14*	39.8	74*	19	43.3	80*	37	54.1	99*	45*	68.6	99*	52*	73.6	99*	52*	73.6	99*	52*	52*	74.0	23*	37.0	65*	10*	
1863..	65*	12*	37.4	63*	2*	35.8	75*	23*	43.7	82*	32*	50.5	92*	45*	66.2	99*	51*	78.5	99*	51*	78.5	99*	51*	78.5	99*	51*	51*	74.0	23*	37.0	65*	10*	
1864..	65*	10*	36.8	65*	3*	37.5	75*	18*	39.9	72*	35*	50.7	92*	40*	67.2	99*	51*	78.6	99*	51*	78.6	99*	51*	78.6	99*	51*	51*	74.0	23*	37.0	65*	10*	
1865..	67*	1*	27.5	68*	17*	32.3	75*	13*	45.5	82*	31*	54.9	92*	42*	68.8	99*	52*	79.7	99*	52*	79.7	99*	52*	79.7	99*	52*	52*	74.0	23*	37.0	65*	10*	
1866..	65*	55*	0*	31.8	68*	6*	32.6	82*	15*	44.8	90*	33*	53.6	86*	35*	53.6	94*	54*	74.3	98*	56*	74.3	98*	56*	74.3	98*	56*	56*	74.0	23*	37.0	65*	10*
1867..	65*	58*	5*	25.5	68*	5*	34.9	68*	16	34.6	80*	20	51.0	90*	44	66.5	99*	55*	74.7	98*	56*	74.7	98*	56*	74.7	98*	56*	56*	74.0	23*	37.0	65*	10*
1868..	64*	5*	25.5	67*	6*	34.7	70*	16	34.7	80*	20	51.0	90*	44	64.6	99*	55*	74.7	98*	56*	74.7	98*	56*	74.7	98*	56*	56*	74.0	23*	37.0	65*	10*	
1869..	63*	23*	37.4	66*	4	37.3	84	28	53.9	92	37	54.7	92	37	54.7	92	37	54.7	92	37	54.7	92	37	54.7	92	37	37	74.0	23*	37.0	65*	10*	
1870..	65*	8*	32.9	64*	6	35.6	64*	8	35.6	64*	14	39.3	88	28	53.9	92	37	54.7	92	37	54.7	92	37	54.7	92	37	37	74.0	23*	37.0	65*	10*	
1871..	65*	4	33.5	71	14	39.3	71	14	39.3	71	13	38.0	89	28	52.6	89	37	54.7	92	37	54.7	92	37	54.7	92	37	37	74.0	23*	37.0	65*	10*	
1872..	65*	49	-6	27.3	63	-4	31.0	71	13	31.0	68	33	51.1	88	40	65.2	89	54*	74.3	98*	55*	74.3	98*	55*	74.3	98*	55*	55*	74.0	23*	37.0	65*	10*
1873..	54	-23</																															

Table containing most of the barometer readings, reduced to sea-level, of 31.00 inches or higher, with dates of occurrence, at Signal Service stations.

Station.	Barometer reading.	Date.	Station.	Barometer reading.	Date.
Albany, N. Y.	31.09	Feb. 5, 1887	Buford, Fort, Dak...	31.00	Jan. 7, 1886
Do	31.04	Dec. 1, 1887	Custer, Fort, Mont...	31.13	Jan. 7, 1886
Assinaboine, Ft. Mont.	31.21	Jan. 6, 1886	Duluth, Minn.	31.00	Feb. 4, 1887
Do	31.18	Jan. 7, 1886	Huron, Dak.	31.07	Jan. 4, 1884
Bennett, Fort, Dak...	31.08	Dec. 6, 1882	Leavenworth, Kans.	31.01	Dec. 7, 1882
Do	31.12	Jan. 4, 1884	Mackinaw City, Mich.	31.00	Nov. 30, 1887
Benton, Fort, Mont.	31.10	Nov. 14, 1872	Moorhead, Minn.	31.01	Feb. 4, 1887
Do	31.06	Nov. 15, 1872	Northfield, Vt.	31.02	Dec. 1, 1887
Do	31.03	Nov. 17, 1874	Oswego, N. Y.	31.00	Nov. 30, 1887
Do	31.07	Jan. 3, 1875	Poplar River, Mont.	31.07	Dec. 1, 1887
Do	31.02	Jan. 4, 1875	Do	31.02	Dec. 6, 1882
Do	31.12	Jan. 8, 1875	St. Vincent, Minn.	31.04	Jan. 22, 1882
Do	31.05	Jan. 12, 1875	Do	31.02	Jan. 23, 1882
Do	31.01	Jan. 13, 1875	Do	31.04	Feb. 17, 1882
Do	31.16	Jan. 6, 1886	Do	31.03	Feb. 4, 1887
Do	31.11	Jan. 7, 1886	Stevenson, Fort, Dak.	31.00	Mar. 11, 1882
Bismarck, Dak.	31.00	Nov. 15, 1874	Do	31.01	Dec. 6, 1882
Do	31.07	Jan. 4, 1884	Sully, Fort, Dak...	31.12	Nov. 18, 1882
Boise City, Idaho	31.04	Dec. 25, 1879	Do	31.01	Nov. 26, 1875
Breckenridge, Minn.	31.00	Feb. 18, 1875	Totten, Fort, Dak...	31.01	Feb. 4, 1887
Buffalo, N. Y.	31.00	Dec. 1, 1887	Wood's Holl, Mass.	31.01	Feb. 5, 1876
Buford, Fort, Dak...	31.04	Mar. 11, 1880	Yankton, Dak...	31.06	Nov. 26, 1873
Do	31.03	Dec. 31, 1883	Do	31.00	Dec. 7, 1882
Do	31.12	Jan. 4, 1884	Do	31.03	Jan. 4, 1884

* Highest recorded, 31.21, at Fort Assinaboine, Mont., January 6, 1886.

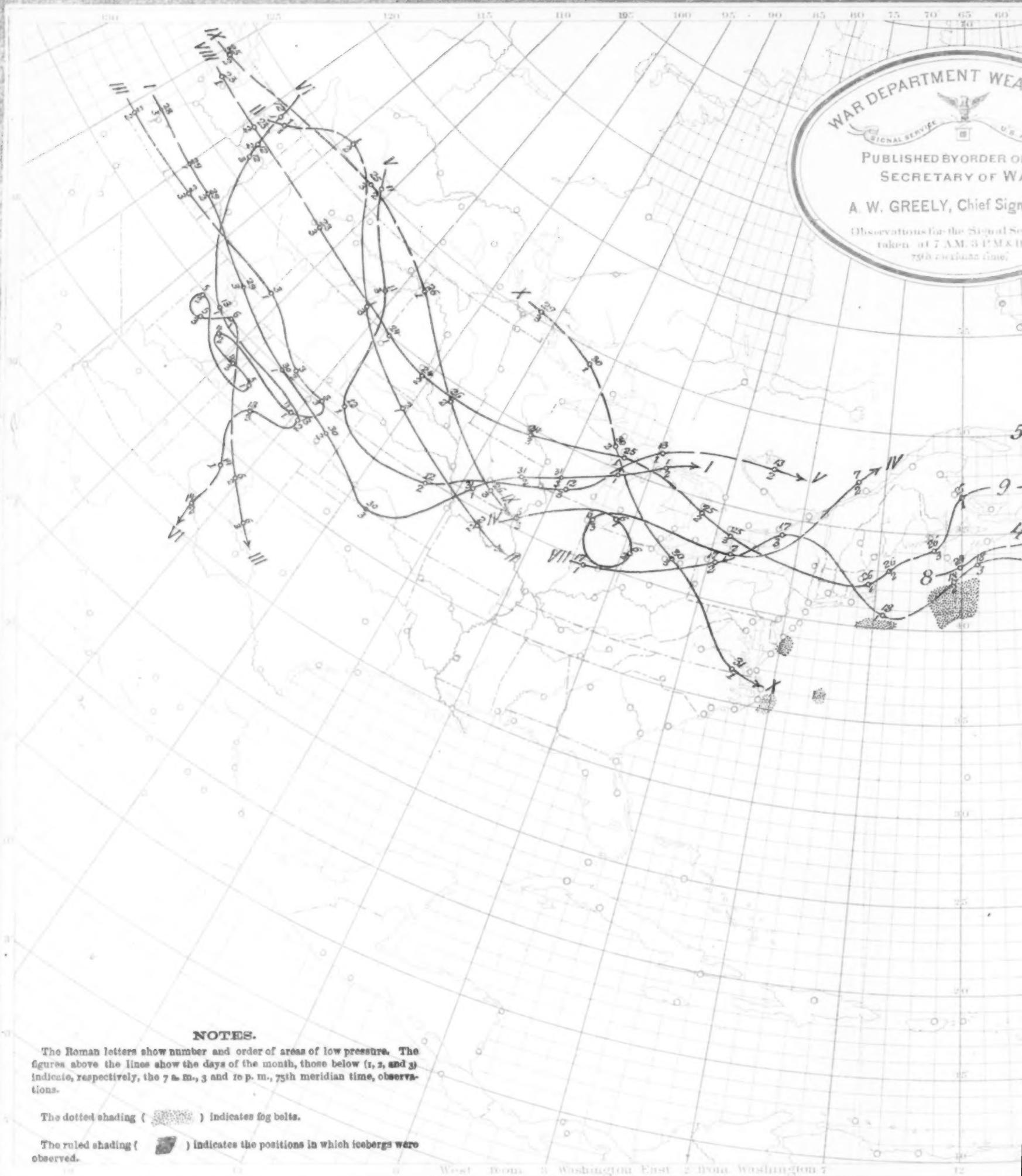
Rainfall (in inches and hundredths) at Troy, N. Y., furnished by Mr. B. H. Baermann, Chief Engineer, Troy Water Works.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1826 ...	2.42	1.64	2.56	1.77	0.93	7.45	4.62	1.14	3.90	2.22	1.99	32.16	32.16
1827 ...	5.18	2.42	2.24	3.98	3.21	3.64	4.28	4.88	4.27	4.32	4.19	42.81	42.81
1828 ...	1.80	1.80	1.17	2.50	4.41	4.25	5.15	1.24	7.97	1.58	5.65	32.01	32.01
1829 ...	4.68	3.19	2.49	4.92	3.26	3.48	2.33	6.61	2.92	2.76	3.77	32.34	32.34
1830 ...	0.97	1.44	4.97	2.09	3.46	2.23	3.92	2.05	2.11	3.55	5.48	34.40	34.40
1831 ...	1.62	2.01	2.36	5.18	2.75	3.98	3.93	3.41	3.92	5.20	2.31	1.16	37.83
1832 ...	4.52	1.99	3.11	4.17	3.23	5.13	4.41	2.37	4.00	3.55	3.83	45.83	45.83
1833 ...	2.92	1.91	0.87	7.86	3.12	4.08	3.50	3.50	3.40	5.67	1.55	44.23	44.23
1834 ...	0.95	0.33	1.82	2.54	3.04	2.87	3.24	1.53	1.99	4.02	0.80	2.66	25.71
1835 ...	0.25	1.30	0.17	1.53	1.86	4.83	3.10	10.95	1.96	2.11	1.00	22.15	22.15
1836 ...	4.93	2.70	1.25	1.60	2.38	4.69	1.93	1.57	1.61	4.40	2.45	4.07	33.58
1837 ...	1.78	2.05	2.31	2.26	4.74	4.65	5.50	2.46	1.55	2.47	1.77	1.77	33.34
1838 ...	...	...	...	...	...	...	...	...	...	...	...	...	...
1839 ...	1.00	0.15	0.58	1.24	0.92	2.65	2.10	0.92	2.59	1.70	1.12	3.26	18.32
1840 ...	1.90	2.85	3.08	3.53	0.20	1.93	1.98	2.55	2.01	3.48	3.30	29.21	29.21
1841 ...	2.30	0.94	1.75	1.50	1.69	2.00	1.29	3.50	4.10	0.85	2.87	5.27	27.84
1842 ...	2.25	1.00	2.00	4.43	0.90	3.17	2.40	3.35	2.90	1.95	1.20	3.95	29.50
1843 ...	1.80	1.90	3.45	2.90	0.73	4.70	2.45	5.10	2.80	4.05	2.20	1.40	32.88
1844 ...	0.81	1.15	1.15	0.50	4.35	3.45	3.60	1.45	1.10	3.05	1.65	1.40	24.46
1845 ...	2.20	1.60	3.00	1.50	2.50	2.35	4.10	2.50	4.35	2.05	2.10	2.50	30.75
1846 ...	1.50	3.70	2.95	2.45	3.27	4.41	0.02	1.36	3.50	2.83	5.59	2.98	37.48
1847 ...	*	*	*	*	*	*	1.49	4.27	3.64	1.76	4.17	15.33	15.33
1848 ...	2.27	1.81	1.99	0.78	6.01	2.91	3.65	3.47	2.99	3.45	1.91	4.69	26.64
1849 ...	0.83	0.80	2.58	3.08	3.53	0.20	1.93	1.98	2.55	2.01	3.48	3.30	29.21
1850 ...	1.87	0.45	2.86	5.40	3.20	5.98	3.07	0.07	5.08	4.41	2.42	4.86	32.88
1851 ...	0.67	3.86	0.65	3.28	2.33	4.26	4.66	1.68	0.88	2.46	4.61	0.29	23.83
1852 ...	2.54	1.11	2.73	4.29	2.41	1.86	3.19	2.45	1.35	3.04	4.09	2.86	31.89
1853 ...	1.13	2.53	2.20	3.53	6.36	3.75	3.74	3.71	6.10	3.10	3.33	1.60	40.16
1854 ...	2.46	2.50	2.49	5.83	1.87	3.05	2.58	1.09	2.28	2.49	2.30	2.08	31.01
1855 ...	2.37	1.40	0.59	2.37	1.94	6.05	4.42	4.05	1.55	5.43	3.37	3.74	42.23
1856 ...	1.00	0.23	1.22	3.31	5.15	4.44	1.74	11.09	4.00	1.16	2.75	2.70	36.79
1857 ...	2.50	1.75	1.05	3.76	4.63	3.51	3.64	2.22	3.31	1.94	3.87	38.51	38.51
1858 ...	2.00	1.03	0.61	2.68	3.35	2.67	9.19	2.19	2.72	3.10	3.00	2.67	30.28
1859 ...	3.13	1.94	2.99	3.39	2.19	4.27	2.92	2.53	4.55	1.22	3.48	3.77	36.37
1860 ...	0.41	1.01	2.35	1.36	2.40	3.54	4.34	4.50	4.39	2.42	3.04	3.20	37.12
1861 ...	3.47	2.60	3.68	2.86	3.82	1.64	4.95	5.49	3.49	2.34	2.72	1.65	41.74
1862 ...	5.33	2.07	3.77	1.83	0.91	7.67	4.25	2.27	0.84	3.74	4.32	1.54	38.52
1863 ...	4.94	2.51	4.04	1.38	5.55	2.04	7.66	2.49	1.62	2.32	5.02	4.10	48.48
1864 ...	1.61	0.86	3.50	4.62	2.43	0.62	1.06	5.69	2.73	2.68	3.68	3.92	33.39
1865 ...	2.27	1.96	4.84	2.87	5.97	1.95	3.62	0.93	2.14	3.88	2.67	34.51	34.51
1866 ...	1.35	1.70	1.08	1.45	2.43	6.71	3.85	1.18	4.73	1.68	2.94	0.66	31.76
1867 ...	2.42	1.91	2.26	3.20	5.75	3.24	3.41	2.79	1.50	3.20	1.64	1.24	37.06
1868 ...	3.33	0.86	2.06	3.79	6.33	3.26	2.35	3.85	8.48	1.58	4.94	4.94	42.41
1869 ...	3.99	3.33	3.81	2.72	2.04	5.79	2.49	1.49	7.46	1.64	2.72	1.65	41.74
1870 ...	4.47	5.08	3.59	2.42	1.44	5.65	5.01	5.56	3.01	2.87	1.82	1.06	41.98
1871 ...	1.60	1.64	3.85	2.40	3.05	4.81	7.24	8.92	1.75	2.37	2.24	1.80	41.70
1872 ...	0.78	1.74	2.70	1.81	4.79	4.68	5.60	5.24	4.88	2.77	2.18	39.12	39.12
1873 ...	3.32	2.11	3.65	1.99	0.99	5.97	2.27	4.78	5.57	3.75	3.03	39.41	39.41
1874 ...	3.96	3.76	1.86	3.57	3.27	7.23	6.23	0.77	3.78	1.76	2.55	0.84	39.37
1875 ...	2.21	1.05	3.46	3.79	2.15	3.67	4.49	4.78	2.42	5.44	2.25	1.20	35.42
1876 ...	1.57	4.09	4.28	3.51	2.96	4.40	4.97	0.53	5.17	1.04	2.65	2.42	35.19
1877 ...	1.94	0.34	2.66	3.13	1.55	4.52	5.08	2.06	1.13	7.84	3.14	0.50	32.90
1878 ...	4.01	3.72	1.94	4.53	4.60	4.68	6.12	3.50	2.63	3.32	5.18	4.70	49.23
1879 ...	2.72	2.23	3.83	2.90	0.65	7.43	5.82	3.60	3.55	1.80	2.76	2.43	38.27
1880 ...	2.80	1.87	1.20	2.07	3.03	1.09	3.04	2.76	2.89	2.43	2.49	1.99	27.65
1881 ...	2.36	2.50	3.80	1.34	3.90	3.76	2.22	2.07	2.38	3.19	3.44	4.88	36.34
1882 ...	2.64	3.31	1.79	1.27	4.15	3.98	3.97	1.35	7.79	0.27	0.97	2.24	33.70
1883 ...	2.43	3.00	1.77	2.65	3.20	6.30	5.95	3.69					



Chart I. Tracks of Areas of Low Pressure

Form 100 G 1884.



Low Pressure. January, 1888.

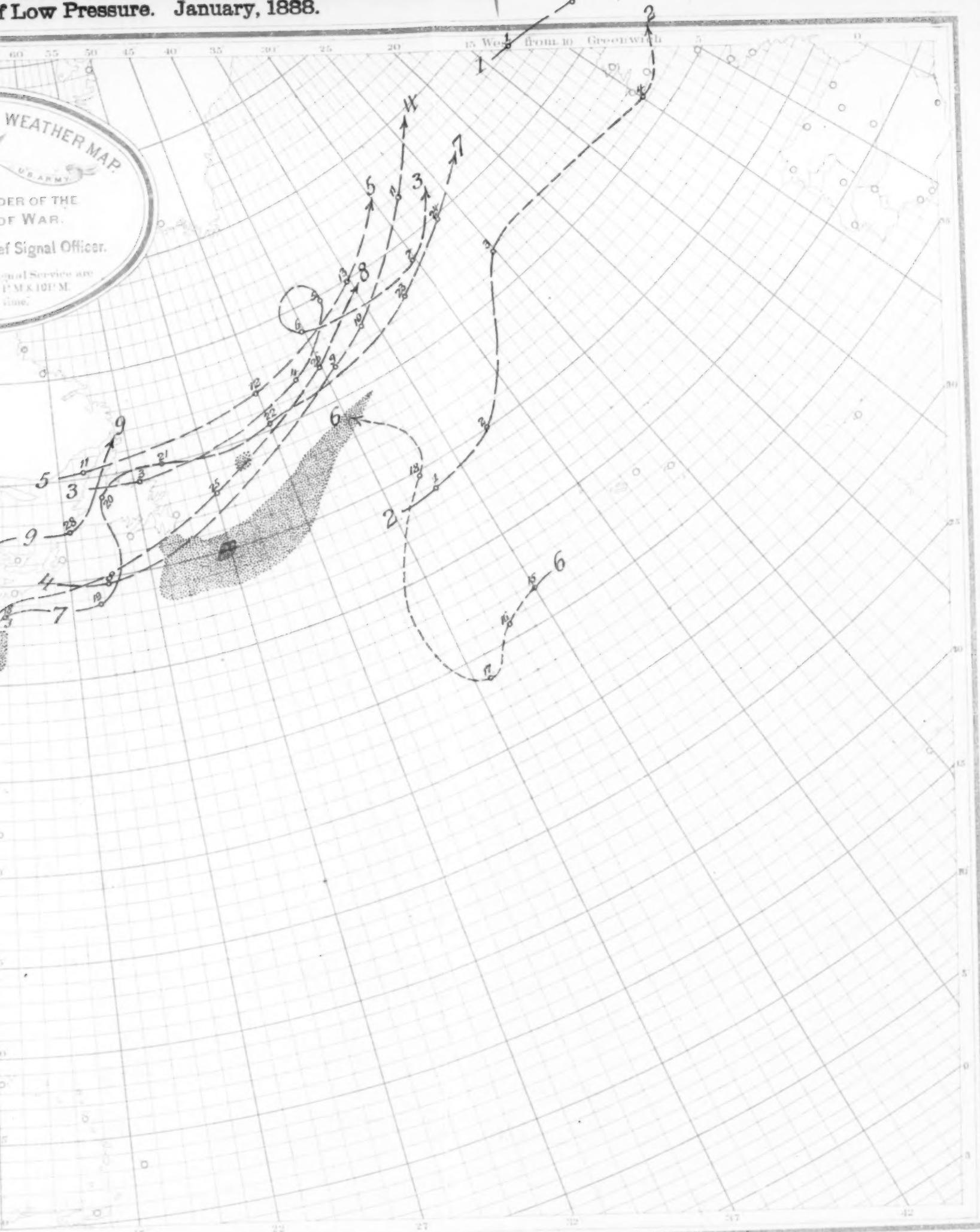
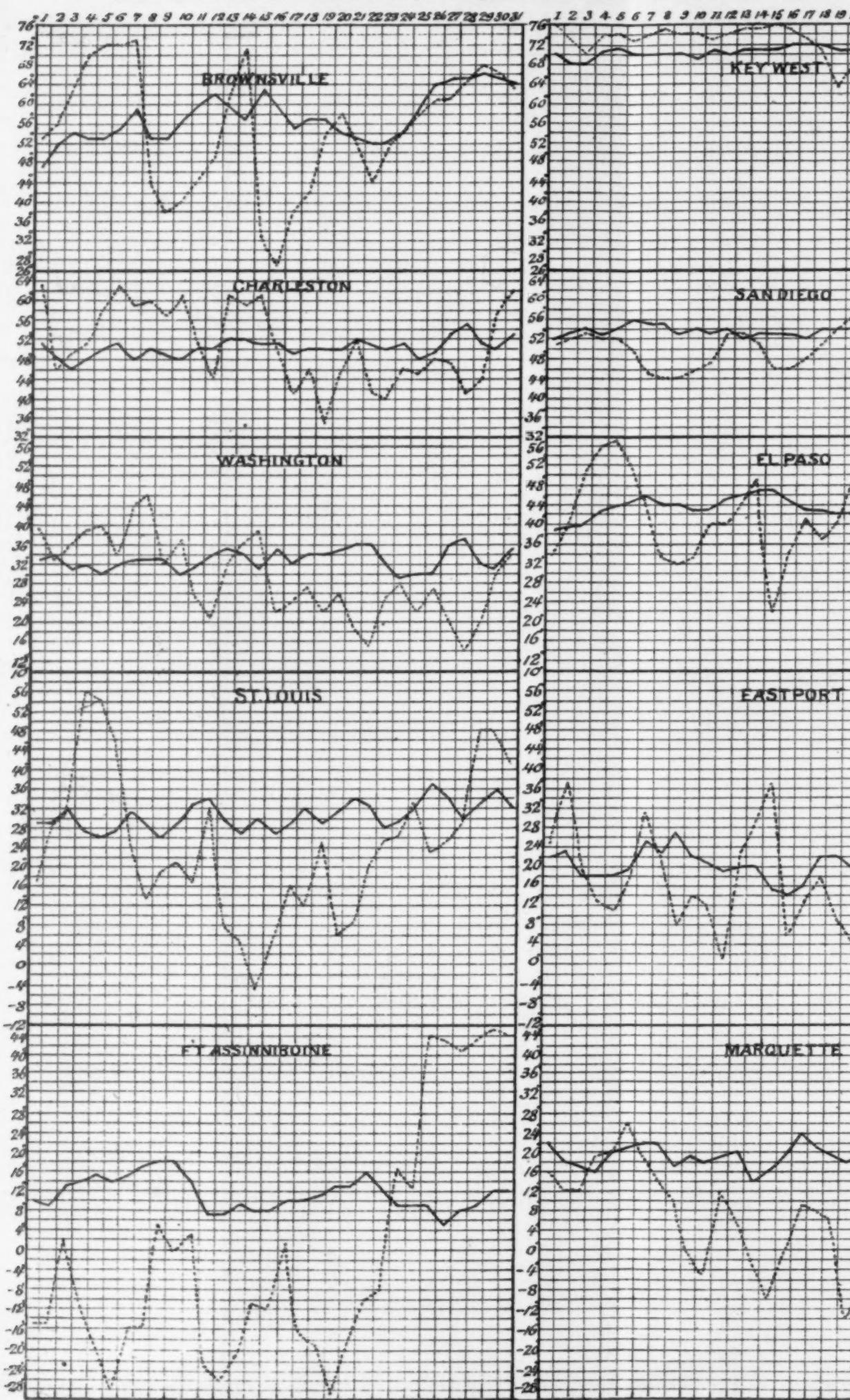
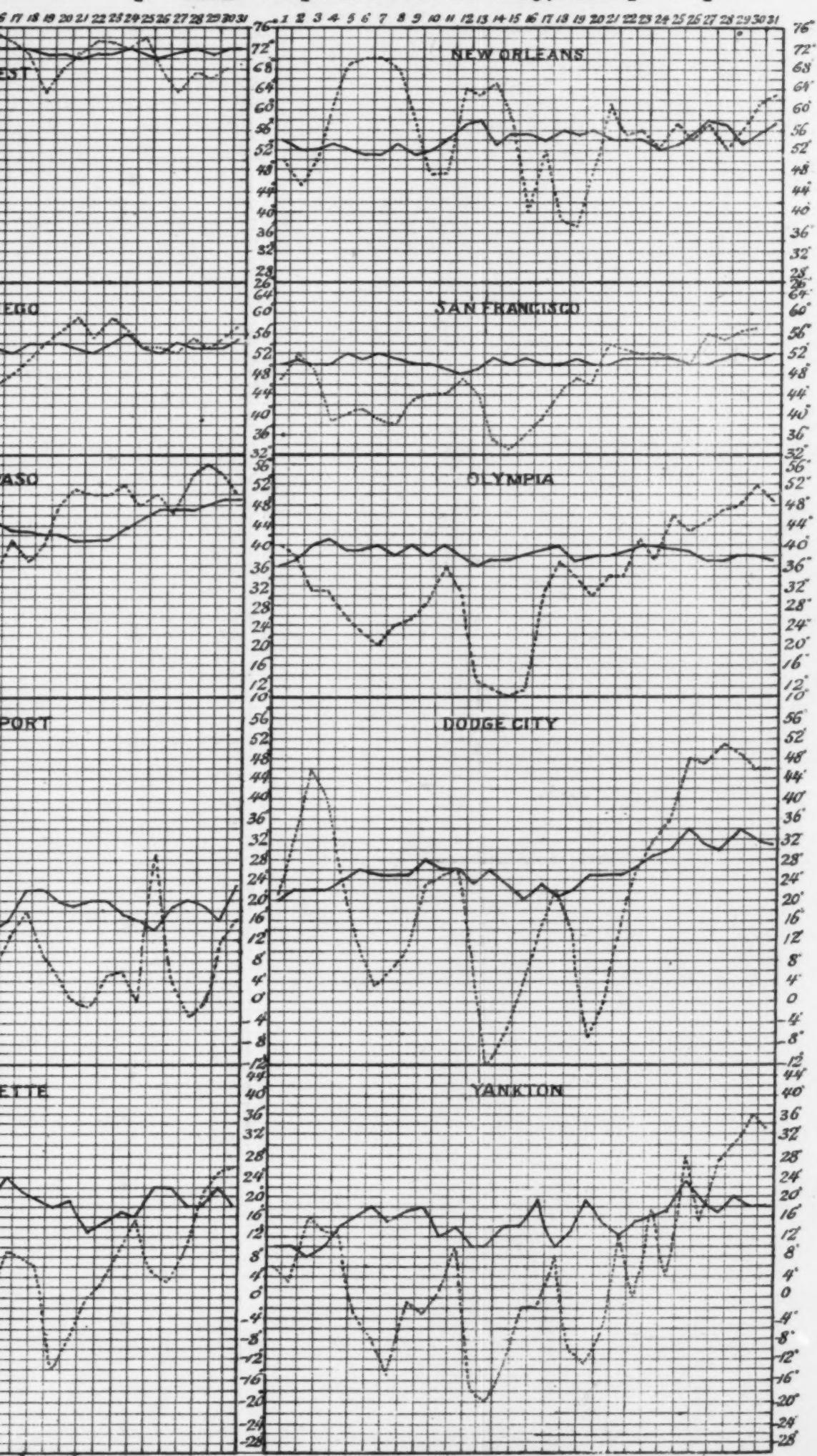


Chart III. Normal January temperatures for a number of years



years [—]. Mean temperature for January, 1888 [.....].



Ward's Entomology 1888.

Chart II. Isobars, Isotherms, and Winds. January, 1888.

P. 133711A 14046 2.

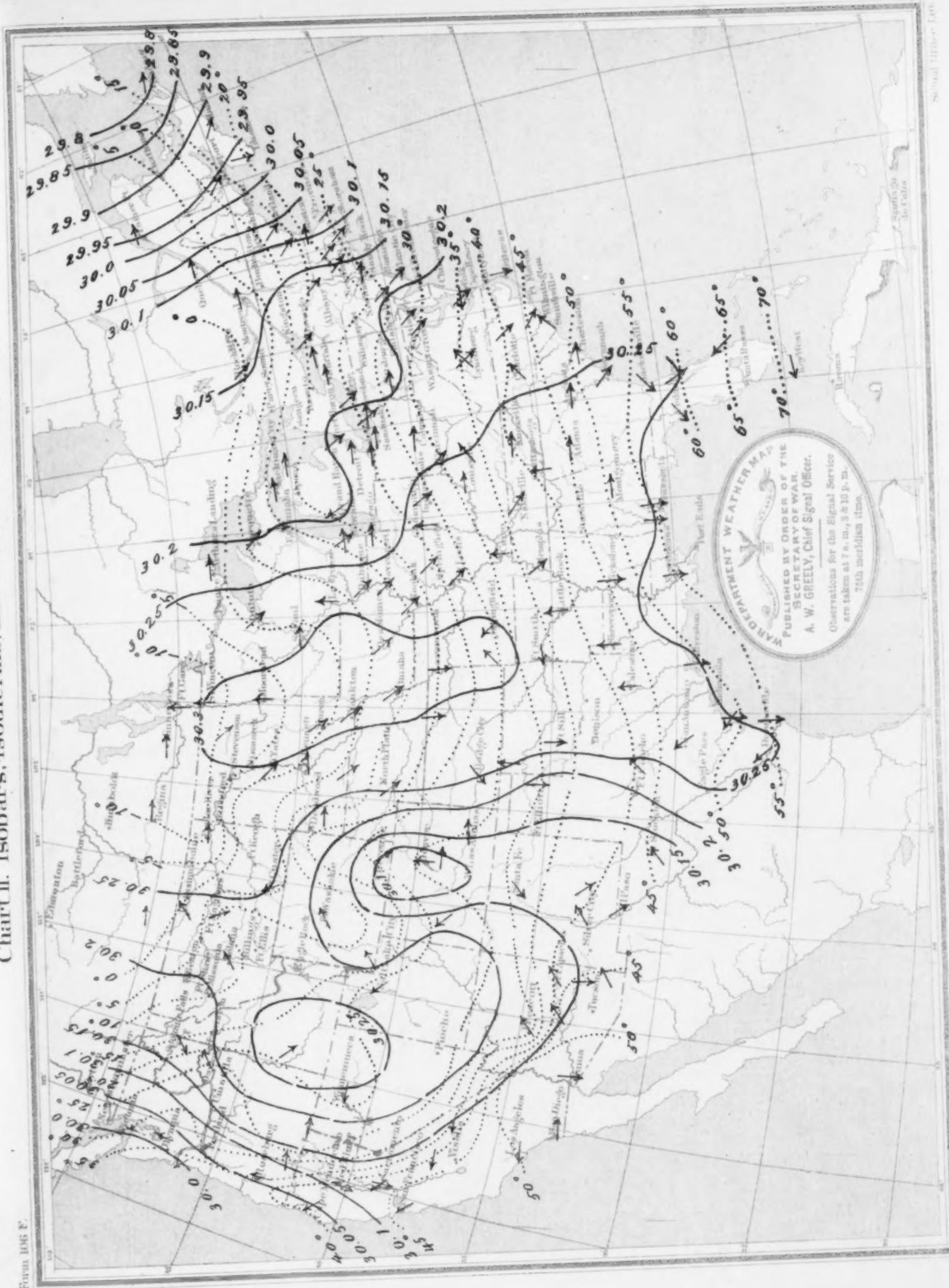


Chart V. Annual Mean Temperature, 1887, and Departures from Normal.

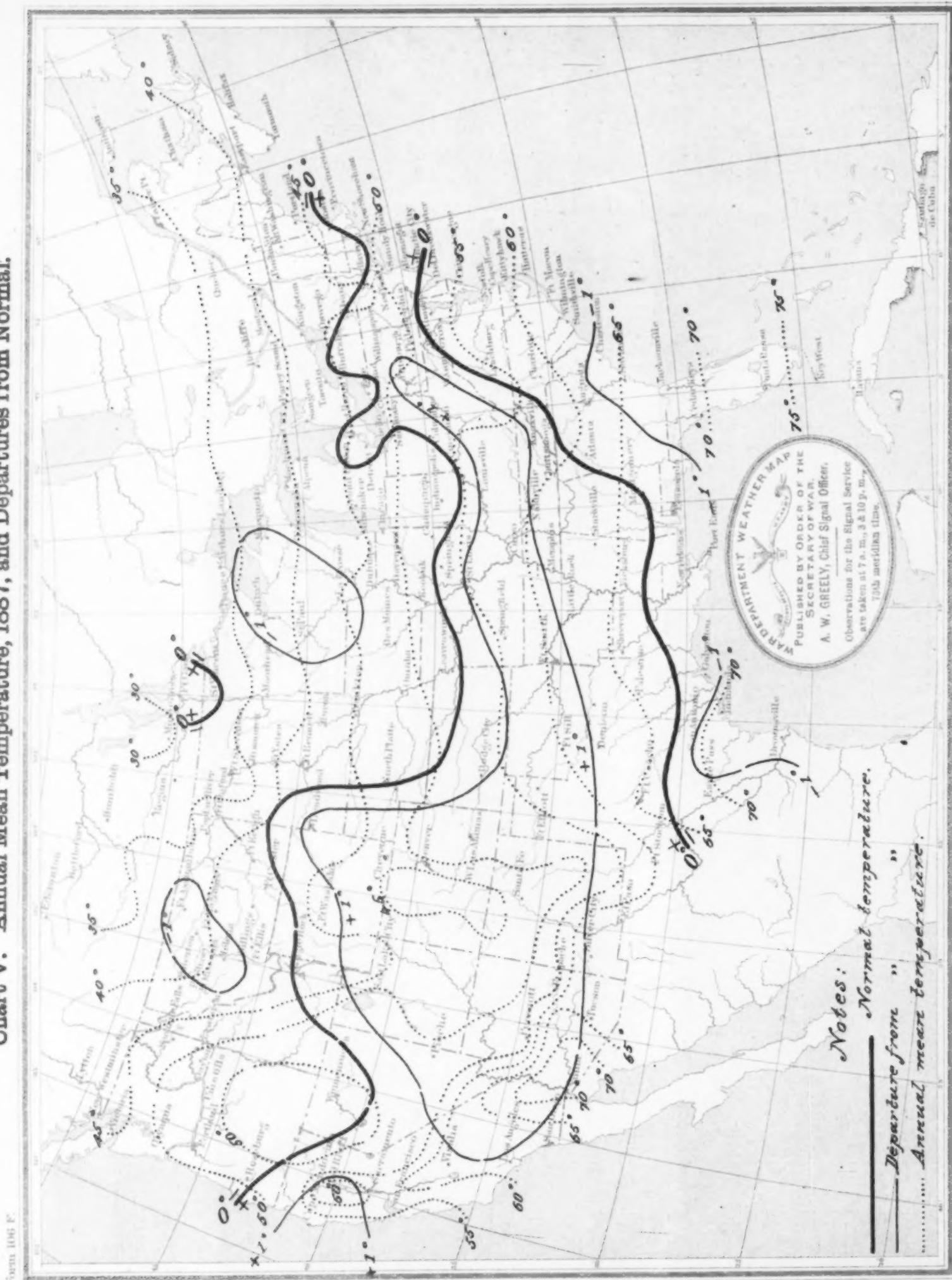
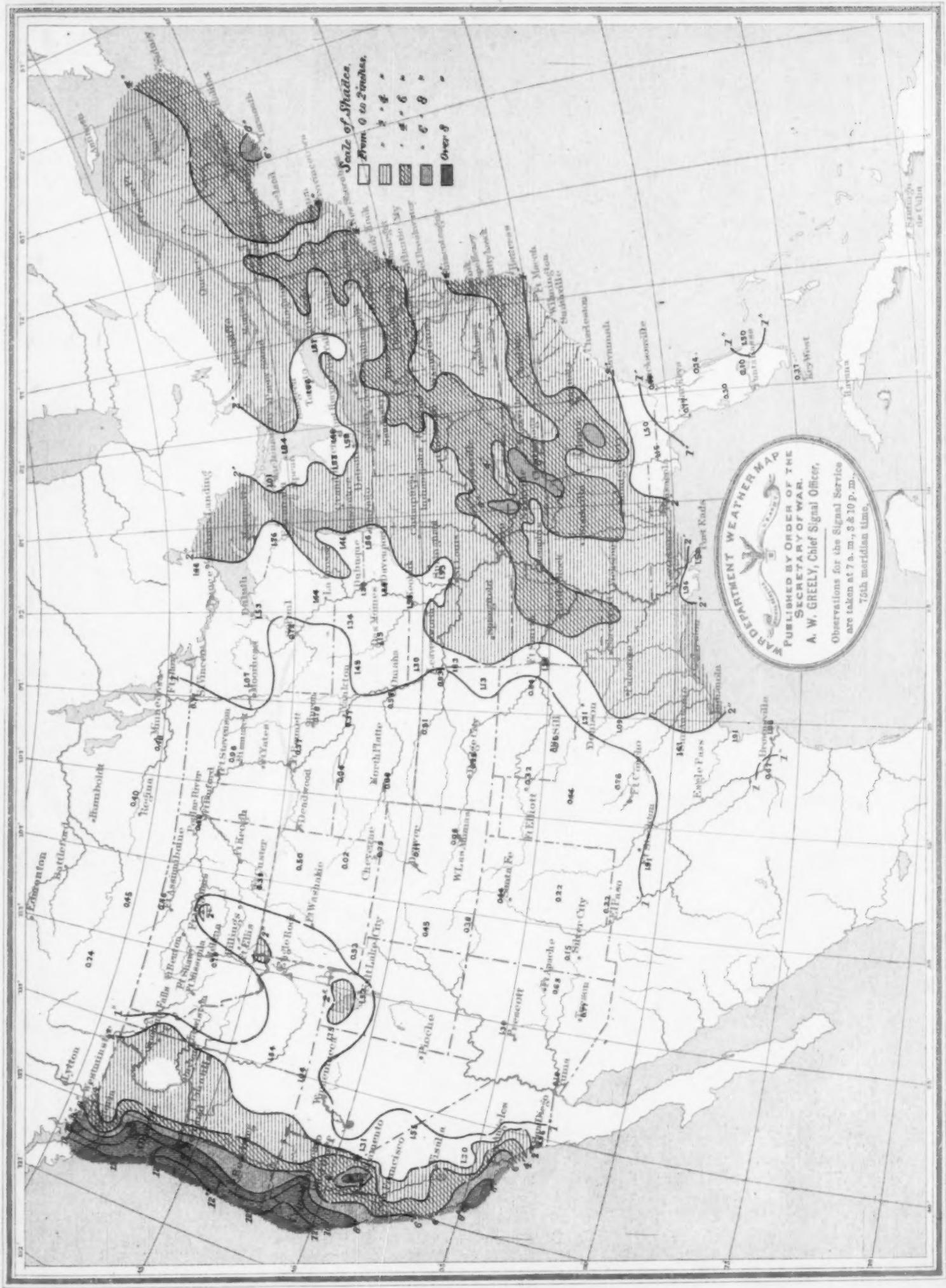


Chart IV. Precipitation, January 1888.

Form 106 F.



Signal Office Lith.

Chart VI. Annual Precipitation, 1887.

